

The Ultrasonic Electrical Stimulation Treating Recent Pain after Minimally Invasive Intervention with Disc Degenerative Diseases

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Abstract:

Objective: To explore the analgesic effect of ultrasonic electrical stimulation for recent pain after minimally invasive interventional therapy for intervertebral disc degenerative diseases (DDD).

Methods: From January to August 2019, 130 patients with DDD who were treated by minimally invasive intervention of intervertebral disc, and then were randomly divided into electrical stimulation group and conservative treatment group. After minimally invasive intervention, the electrical stimulation group was treated by ultrasonic electrical stimulation once a day for 7 days. The conservative treatment group was treated with conventional acupuncture and massage once a day for 3 days. The pain degree of before treatment and 3 days, 7 days and 1 month (m) after treatment were evaluated by pain numerical rating scale (NRS), the curative effect of 1 m post-cure was evaluated by NRS weighting method.

Results: There was no significant difference of NRS score between the two groups before treatment ($P > 0.05$). NRS of electrical stimulation group were significant lower than those in conservative treatment group, which was evaluated at several time point for 3 days, 7 days and one month after treatment ($P < 0.001$). The curative effect of electrical stimulation group on one month after interventional treatment was significantly higher than that of conservative treatment group ($P < 0.001$).

Conclusion: The therapeutic effect of ultrasonic electrical stimulation is better than that of traditional acupuncture and massage for recent pain after minimally invasive interventional therapy with DDD, it is worthy to popularize in clinical treatment.

Keywords: anticoagulation; COVID-19; carotid thrombus; hypercoagulability; stroke

Introduction

The DDD is a kind of disease characterized by pain with the intervertebral disc degenerative lesions. Clinically, the most common pain is in neck, shoulder, back and limbs. According to statistics, the incidence of cervical spondylosis and low back pain is 3.8%~17.6% and 67% in adults respectively, 56% of which are root pain or sciatica [1]. Minimally invasive interventional therapy (such as nerve root block, radiofrequency therapy, nerve regulation, spinal endoscopy, etc.) has a good effect for DDD [2], but which needs to recover one to three months after minimally invasive interventional therapy and tend to be stable. However, mechanical compression and inflammatory stimulation will lead to pain during this period. Ultrasound electrical stimulation is an innovative physiotherapy for chronic pain repair, which integrates biological wave, bioelectricity, biomagnetism, and small molecule transdermal delivery technology. It has good therapeutic effect for pain with tissue

inflammation elimination and damaged nerve repair. Since there are still pain caused by inflammatory stimulation and other factors after minimally invasive interventional therapy, so effectively alleviating the pain in the recovery period after minimally invasive interventional therapy and improving the patients' satisfaction with the efficacy, the physical therapy was carried out by using ultrasonic electrical stimulation, and its analgesic effects for recent pain post cure of intervention were researched, and compared with those using traditional conservative treatment.

Materials and Methods

1. General data

A total of 130 patients with DDD including 47 males and 83 females, aged 26-85 years with an average age of (53.62 ± 7.7) years, were selected for minimally invasive interventional treatment of intervertebral disc in our

hospital from January to August 2019. The lesions were including cervical spondylosis and degenerative disease of lumbar intervertebral disc. The patients were randomly divided into two groups by random number method with 65 patients respectively in two groups.

2. Methods

The patients in two groups were treated with ultrasonic stimulation and conventional conservative therapy respectively after minimally invasive interventional therapy. In the electric stimulation group, the corresponding spinal nerve innervation area was treated with ultrasonic electric stimulation. The electric stimulation treatment was carried out with TU-B02 super generation electric stimulation treatment instrument (Shenzhen tairuikema Medical Technology Co., Ltd., China) with current range at 40 to 50, once a day, 20 min each time, and the treatment course was 7 days. The patients in conservative treatment group were treated with conventional acupuncture and massage, once a day for 20 minutes, consecutive 7 days. There was not using any analgesic in 2groups after minimally invasive interventional therapy. The every patients in inpatient for study of pain treatment were assessed to the intensity of pain using pain numerical rating scale (NRS) on 3d, 7d after interventional treatment. The every patients of left hospital for study of pain treatment were scheduled for follow-up with NRS of assessment on 1 month of post cure.

3. Observation indexes

Before treatment, 3 days, 7 days and 1 month after treatment, the pain degree of patients was evaluated by NRS. The recent analgesic effect was assessed on 1 month after the treatment by NRS weighting method.

The recent analgesic effect evaluated by NRS weighting method: Curative, $(a-b) / a \times 100\% \geq 75\%$, excellent, $(a-b) / a \times 100\% \geq 50\% \sim < 75\%$, effective, $(a-b) / a \times 100\% \geq 25\% \sim < 50\%$, ineffective: $(a-b) / a \times 100\% < 25\%$. The rate of every analgesic effect in 2 group was calculated, which method is cureative n, excellentn ,effective n (respectively)/ 65 × 100%.The total effective rate of every group = (cureative n+ excellent n +effective n) sum/ 65 × 100%. a: NRS before treatment; b: NRS post cure 1 month.

4. Statistics

Data were processed by SPSS 20.0 statistical software (SPSS software co., Chicago, IL, USA). Rate was used to describe the counting data, chi square test was used for the comparison between groups. The measurement data was described by mean ± standard deviation ($\bar{x} \pm sd$), difference between groups was compared by independent *t* test, and the level of statistical significance was taken as $P < 0.05$.

Results

1. General data comparison

There was no significant difference in gender, age and lesions between the two groups ($P > 0.05$).(Table 1).

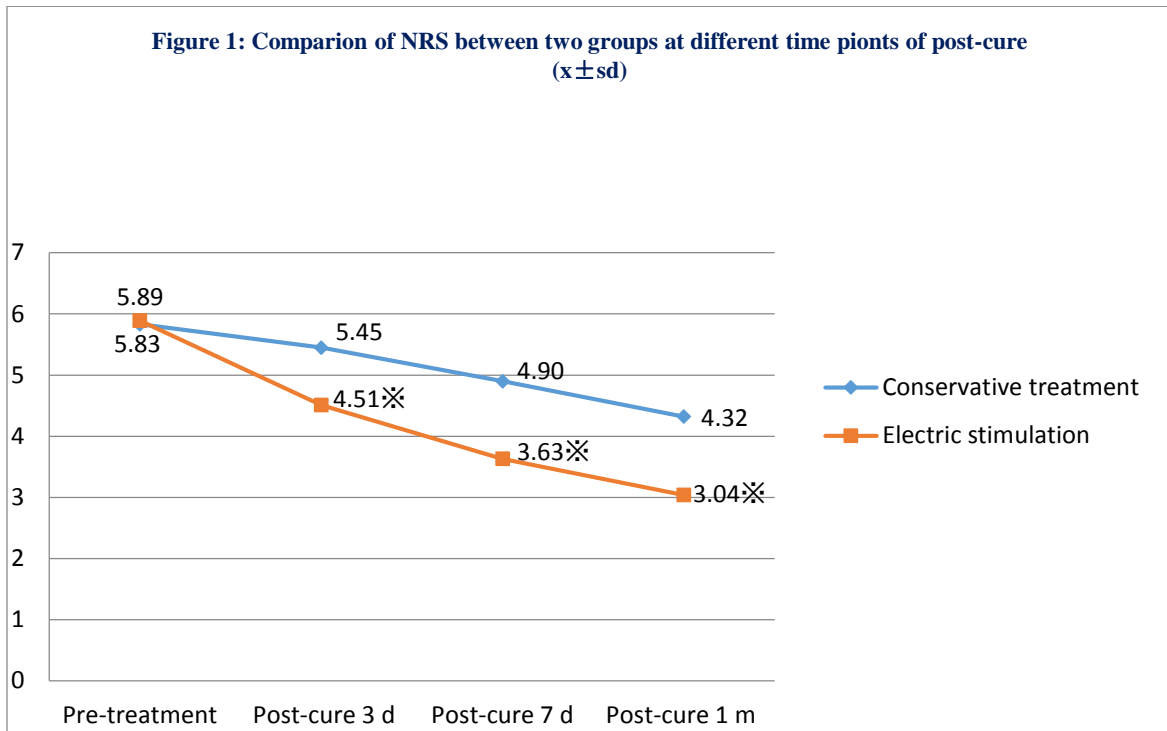
General data	Items	Conservative group	Electric stimulation group
Gender	male	26 (40.0)	21 (32.3)
	female	39 (60.0)	44 (67.7)
Age (years)	<50	14 (21.5)	11 (16.9)
	≥50	51 (78.5)	54 (83.1)
Lesions	cervical vertebra	11 (16.9)	9 (13.8)
	lumbar vertebra	54 (83.1)	56 (86.2)

Table 1: Comparison of general data between two groups [n (%)]

2. Comparison of NRS between the two groups at different time points of post cure

There was no significant difference of NRS between the two groups before treatment ($P > 0.05$). The significant difference of NRS was found between the two groups at 3 days, 7 days and 1 month of after treatment. The NRS of the electric stimulation group was significant lower than that

of the conservative treatment group ($P < 0.001$). There were significant differences of NRS between the two groups at different time points of post cure ($P < 0.001$). Figure-1:



Note: ※ compared with the conservative treatment group, $P < 0.001$.

3. Comparison of every analgesic effect rate between the two groups on post cure 1month (m).

The total effective rate of the conservative treatment group and electric stimulation group was 72.3% and 95.4% respectively. The analgesic effect of electric stimulation group (E.S.G) was significant superior to the

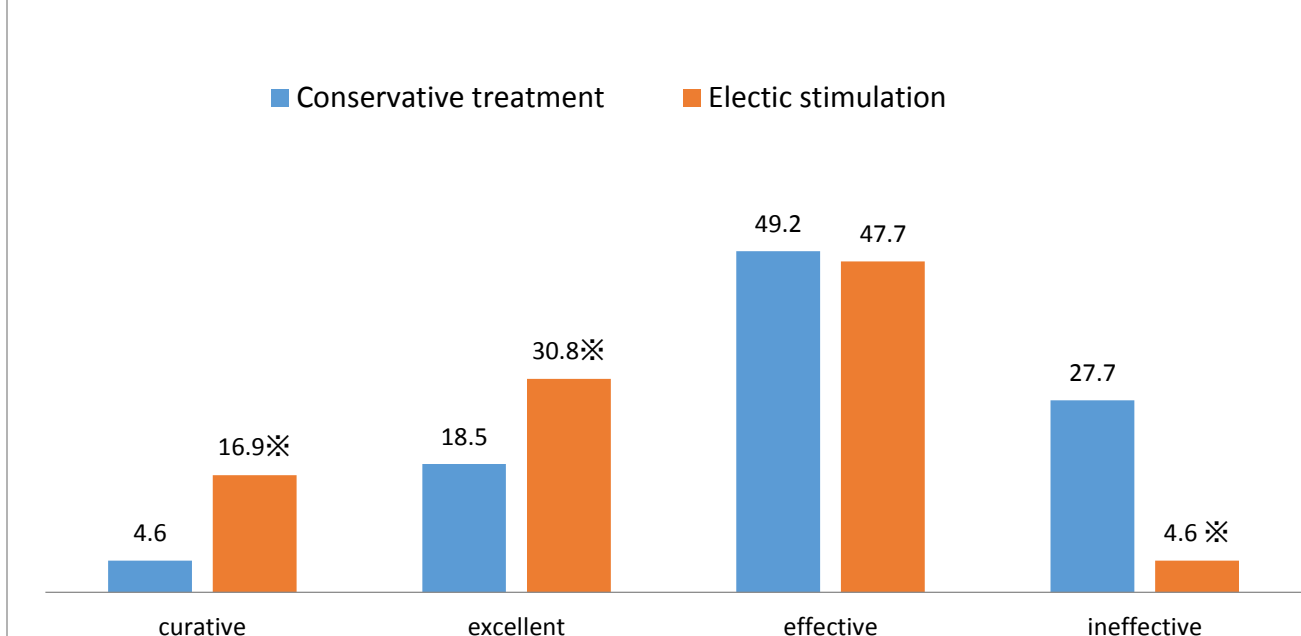
conservative treatment group (C.T.G). There was statistically significant difference of curative and excellent rate between the two groups on post cure 1m ($P < 0.001$). The ineffective rate of the electric stimulation group was significant lower than that of the conservative treatment group ($P < 0.001$), as shown in Table 2.

Analgesic effect	C.T G n (%)	E. S.G n (%)
Curative	3(4.6)	11(16.9)※
Excellent	12(18.5)	20(30.8) ※
Effective	32(49.2)	31(47.7)
Ineffective	18(27.7)	3(4.6) ※
Total effective rate	72.3(47/65)	95.4(62/65) ※

Note: ※ compared with the conservative treatment group, $P < 0.001$.

Table 2: Comparison of analgesic effect rate between 2 groups on post cure 1m

Figure 2: Comparison of analgesic effect rate between two groups on post-cure 1 m (%)



Note: * compared with the conservative treatment group, $P < 0.001$.

Discussion

Spinal degenerative radicular pain is a kind of disease characterized by pain caused degeneration of intervertebral disc. The degradation of disc collagen and proteoglycan, the disorder of cell metabolism, and the degeneration of intervertebral disc vary in different degrees with the increase of age [3-4]. Timely and effective treatment is the key to recovery. At present, with the rapid development of minimally invasive interventional therapy technology, it is widely used in various medical fields [5-6], not only has the advantages of small trauma, high precision, good efficacy and easy recovery, but also can significantly improve the quality of life of patients [7]. However, some potential pain has always been a common problem for patients after minimally invasive treatment. In the recovery period of 1-3 months after interventional therapy, different treatment methods have different control effects for the pain, while electrical stimulation therapy has a good effect on postoperative pain [8-9].

In addition to causing spinal nerve root pain, spinal degenerative lesions can also cause intervertebral space height reduction, the inner layer of the fibrous ring tear, the formation of inflammatory granulation zone, which leading to low back pain due to stimulate the sinus nerve. At the same time, the end plate lesions (Modic changes) increase the axial load and stress of the end plate, and then cause the end plate and the end plate bone micro fracture. The local inflammation of lumbar spine caused by the internal inflammatory material of the nucleus pulposus through the endplate diffusion is also an important cause of low back pain. The studies have shown [10]: Phospholipase A₂ in deep lumbar muscles of patients with lumbar disc herniation, In addition to the inflammatory response in the spinal canal involved in the formation of nerve root pain with lumbar disc herniation, the inflammatory response in the spinal soft tissue

damage may also be an important factor causing lumbar and leg pain. This inflammatory response can lead to pain in the lumbar and leg and muscle spasm, which caused by muscle-damaging inflammation. Disc minimally invasive interventional therapy can effectively relieve discogenic pain and nerve root pain symptoms, but there is no targeted treatment for extravertebral-canal pathogenesis, so the short-term analgesic effect is not good, there are still different degrees of low back pain symptoms within 1 months after interventional therapy. Therefore, in the pathogenesis of low back pain [11], the formation of a vicious circle centered on low back pain, that is : " pain - muscle tension - local blood circulation disorder ". From pain defense response of the back pain as the basis point, leading to the waist muscle tension, lumbar tilt to the back, local circulation disorders, these changes can make low back pain , muscle tension, local circulation disorder aggravated, resulting in the vicious circle caused by the interaction of three pathological factors.If the measures are not taken to interrupt this vicious circle, the recent low back pain after minimally invasive interventional therapy can not be well alleviated.

Therefore, for lumbar degenerative disease after minimally invasive interventional treatment of residual low back pain, we must take measures to relieve the pain caused by soft tissue damage outside the spinal canal, so the comprehensive physical therapy will obtain satisfactory results. According to this study, ultrasound electro-stimulation therapy has obvious relief effect for pain and tension on the lumbar and hip muscles with DDD patients in spasmodic ischemia for a long time and the state of waist muscle tension, which can improve blood supply, so finally achieve the purpose of eliminating inflammation, relieving pain, restoring muscle and nerve function.

Ultrasonic wave has the mechanical, thermal, physical and chemical effects, it is elastic longitudinal wave, its sound pressure can make the

cytoplasm fluctuate. Both the mechanical and thermal effects can trigger some physical and chemical changes, including the following effects: diffusion, that is, enhance biofilm diffusion process, promote substance exchange, improve tissue nutrition and metabolism; thixotropic effect, that is, release of muscle and connective tissue; depolymerization, even if drug depolymerization, is conducive to drug penetration into the tissue, improve drug efficacy, so that drugs can more into the tissue and be used by the tissue. Among them, the warming effect is an important therapeutic factor, which can cause changes in vascular function and metabolic process, improve local blood and lymphatic circulation, enhance cell permeability, soften tissue, enhance infiltration, promote blood circulation, and stimulate the regeneration of damaged tissue. Reduce muscle and connective tissue tension and relieve the vicious circle of muscle spasm and pain. In addition, it can also reduce the excitability of peripheral sensory nerve, reduce peripheral pain sensitization, and produce local analgesic effect.

When the intermediate frequency current acts on the therapeutic site, the physical and chemical reaction of polarization or depolarization is produced in the nerve endings of the tissue, and then the sensory nerve conduction block is caused. At the same time, the intermediate frequency current can overcome the tissue resistance of the body and make the drug import, thus increasing the speed and quantity of the drug import into the human body. Therefore, under the introduction of ultrasound, it is beneficial to the absorption of drug introduction, so that the time of percutaneous drug delivery is greatly shortened, and the effect of drug introduction treatment is greatly improved. The carrier bioelectricity of the ultrasound electrostimulator can also regulate the membrane potential of neuronal cells, promote the metabolism of cells and the exchange of nutrients, and thus achieve the effect of repairing damaged nerves and eliminating inflammation [12].

In short, ultrasonic electrical stimulation therapy is an innovative chronic pain repair and treatment measure, which integrates biological wave, bioelectricity, biomagnetism and small molecule transdermal delivery technology. It not only can effectively alleviate the pain caused by inflammation of myofascial, muscle and nerve root, but it also has repairing effect to nerve of damage by superposition of several technical principles of low medium frequency electricity, ultrasonic, electromagnetic and laser [13]. This study showed that the NRS of 3 days, 7 days and 1 month after minimally invasive interventional therapy was significantly lower than that of the conservative treatment group. Electrical stimulation therapy could relieve the recent pain after interventional treatment, increase the comfort and improve the satisfaction of patients. The carrier bioelectricity of ultrasonic electric stimulation therapy instrument can regulate the membrane potential of neuron cells, promote the exchange of oxygen and nutrients of cells, so as to achieve the effect of repairing damaged nerves and removing inflammation. One month after treatment, the analgesic effect of the two groups was evaluated and found that the total effective rate of the electric stimulation group was significantly higher than that of the conservative treatment group (95.4% vs 72.3%, $P < 0.001$), indicating that the electric stimulation group was superior to the traditional conservative treatment in effect of control recent pain after interventional treatment. Ultrasonic

electrical stimulation can effectively relieve recent pain after interventional therapy for patients with DDD, and achieve relatively satisfactory results, which is of great significance to improve the comfort and quality of life of post cure patients, so it is worthy to popularize in clinical treatment.

Reference

1. Pain branch, Chinese Medical Association. Expert consensus on the treatment of spinal degenerative radicular pain (China)[J].Natl Med J China,2019,99(15):1133-1137. DOI:10.3760/cma.j.issn.0376-2491.2019.15.003.
2. Türk C, Petřík A, Sarica K,et al. EAU Guidelines on Interventional Treatment for Urolithiasis[J].Eur Urol. 2016,69(3):475-82. DOI: 10.1016/j.eururo.2015.07.041.
3. Genevay S, Courvoisier DS, Konstantinou K,et al. Clinical classification criteria for radicular pain caused by lumbar disc herniation: the radicular pain caused by disc herniation (RAPIDH) criteria[J].Spine J. 2017,17(10):1464-1471. DOI: 10.1016/j.spinee.2017.05.005.
4. PengB, BogdukN, DePalmaMJ, etal. Chronic Spinal Pain: Pathophysiology, Diagnosis, and Treatment. [J] PainRes Manag, 2019,2019:1729059.DOI:10.1155/2019/1729059.
5. Guevara-López UI, Covarrubias-Gómez A, Elías-Dib J,et al.Practice guidelines for the management of low back pain. Consensus Group of Practice Parameters to Manage Low Back Pain[J].Cir Cir.2011,79(3):264-79,286-302.
6. McGowan JE, Ricks CB, Kanter AS, et al. Minimally Invasive Treatment of Spine Trauma [J].Neurosurg Clin N Am. 2017,28(1):157-162. DOI:10.1016/j.nec.2016.08.010.
7. Koban O, Ogrenç A, Yaman O,et al. Phantom Radicular Pain Treated with Lumbar Microdiscectomy: A Case Report[J].Turk Neurosurg. 2019,29(1):145-147. DOI: 10.5137/1019-5149.JTN.19768-16.1.
8. Sadala AY, Machado AFP, Liebano RE. Effects of transcutaneous electrical nerve stimulation on pain intensity during application of carboxytherapy in patients with cellulite: A randomized placebo-controlled trial[J].J Cosmet Dermatol. 2018,17(6):1175-1181. DOI: 10.1111/jocd.12489.
9. Rock JM, Rainey CE. Treatment of nonspecific thoracic spine pain with trigger point dry needling and intramuscular electrical stimulation: a case series[J]. Int J Sports Phys Ther. 2014,9(5):699-711.
10. Yin Xiangjiao, Gong He, Wang Lizhen, Zhang Xizheng. Advances in research on influencing factors and related morphological and structural changes of disc degeneration [J]. Biomedical Engineering & Clinical, 2016, 20(01):112-117.
11. Yuanwei Zongshi, Qu Chengye. Block therapy for low back pain [J]. Introduction to Japanese Medicine, 2003, 24(6):263-264.
12. Liu Tanghua. Ultrasound therapy instrument for cervical and lumbar degenerative diseases observation. Chinese Journal of Pain Medicine, 2016, 22(11):876-877.
13. Cressman JR, Gertz M, Chitnis PV. Ultrasonic stimulation and metabolic stress in neuronal systems [J]. J Acoust Soc Am,2017,142:2668. DOI:10.1121/1.5014723.



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