Combined Efficacy of Pregabalin and Suspension System in Lumbar Disc Herniation and its Impact on JOA and ODI Score

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People diagnosed with lumbar disc herniation-associated low back pain were recruited from our hospital between January 2020 and October 2022. They were randomized into two groups; control group (n=150) underwent pregabalin treatment, while the experimental group (n=150) received a combination of pregabalin and suspension exercise suspension system treatment. The study compared the therapeutic effect, lumbar function, muscle strength and pain between the two groups before and 4 w after treatment. The total effective rate of treatment in the test group, which received pregabalin combined with suspension exercise suspension system, was 94.00 %, significantly higher than that of the control group (87.33 %) ($p<0.05$). After 4 w of treatment, both groups showed an increase in the functional independence scale score and a decrease in the oswestry index score. Moreover, in the experimental group, the functional independence scale score was significantly higher compared to that of the control group, while the oswestry index score was significantly lower. The extensor and flexor muscle strength of both groups also improved after 4 w of treatment, but the test group had significantly higher strength compared to the control group ($p<0.05$). The Japanese orthopaedic association score increased and the visual analog scale score decreased after 4 w of treatment in both groups. The experimental group showed significantly higher Japanese orthopaedic association score than the control group and a lower visual analog scale score than the control group. In the management of low back pain caused by lumbar disc herniation, pregabalin combined with suspension exercise suspension system exhibits a remarkable therapeutic effect. It aids in reducing the intensity of low back pain while enhancing lumbar muscle strength, ultimately fostering a functional recovery of the lumbar region.

Key words: Low back pain, suspension exercise suspension system, lumbar disc herniation, pregabalin, awakening effect

Lumbar Disc Herniation (LDH) is a common occurrence in spinal surgery, mainly caused by degenerative alterations in different sections of the lumbar intervertebral disc that lead to compression of the relevant spinal nerves. A telltale sign of this condition is low back pain[1,2]. If left untreated, LDH can significantly impact the patient's quality of life. Rational drug use is one of the effective ways to treat low back pain in LDH[3,4]. Pregabalin is a frequently used medication for managing low back pain caused by LDH. This medication can effectively counteract peripheral and central sensitization, demonstrating a certain potency in treating LDH associated low back pain. However, using pregabalin alone may result in inadequate therapeutic outcomes[5]. The Suspension Exercise Treatment (SET) suspension system uses adjustable ropes and slings to maintain the patient's balance and posture, thus helping the muscles to relax and contract, and play a dormant and awakening effect on the core muscles of the spine, which is of great help for the muscles to reconstruct the normal functional model[6]. Nevertheless, there is a need to further investigate the mechanism through which pregabalin combined with SET suspension system enhances the muscle strength of patients diagnosed with low back pain associated with LDH. For this purpose, we recruited 300 patients with LDH low back pain to investigate the potential benefits of

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pregabalin combined with SET suspension system. The following section provides detailed insights into the study. Our study included a total of 300 patients diagnosed with LDH low back pain treated at our hospital between January 2020 and October 2022. The participants were randomly assigned to two groups. The control group comprised 61 females and 89 males with an age range of 41 y-76 y and an average age of (56.40±5.56) y. The duration of the disease ranged from 3-18 mo with an average of (9.52±1.36) mo. On the other hand, the experimental group comprised 59 females and 91 males with an age range of 42 y-77 y and an average age of (56.48±5.41) y. The duration of the disease ranged from 3-19 mo with an average of (9.70±1.42) mo. The baselines of the two groups of data are consistent and comparable ($p>0.05$). The proposed experimental design of this study underwent a rigorous review process by the Ethics Committee of our hospital and was approved for implementation. The inclusion criteria including the LDH low back pain diagnosis refer to the relevant standards[7]; patients can communicate normally; performance of different degrees of lower limb radiation pain and low back pain. The exclusion criteria including the spontaneous withdrawal; lumbar deformity or severe calcification; lumbar tuberculosis or vertebral metastasis; lumbar spondylolisthesis and lumbar spinal stenosis. The control group was given pregabalin (Chinese medicine standard word H20213706, 150 mg, Shijiazhuang Longze Pharmaceutical Co., Ltd.) orally, taking 75 mg twice a day on the 1st and 2nd d, and 150 mg twice a day for 4 w from the 3rd d. The experimental group received treatment with pregabalin in combination with the SET suspension system. Weak chain testing was performed on patients while under the suspension system, including supine pelvic lift, prone bypass, supine bypass, prone hip flexion, supine knee flexion, lateral adduction and lateral abduction, etc., the patients completed the corresponding movements under the guidance of the physician and the different movements were divided into 5 grades according to the degree of completion, among which less than 3 grades were weak chain. After determining the weak chain muscle group of LDH patients with low back pain, the therapist establishes the SET suspension target muscle group according to the specific condition of the patient. Initial SET training action; guide the patient to complete the lowest level of test action. Training mode has low-load, long-time, closed-chain exercise. Initial difficulty has the highest level of action that can be completed under the SET suspension system. Sign of completion of training; each movement can be completed painlessly, symmetrical on both sides, each movement for 2 min, 4-5 times in each group, a total of 3-4 groups, with an interval of 30 s each time. SET suspension training needs to be completed step by step, and the training level is gradually increased, 5 times a week, and the course of treatment is 4 w. Curative effect including the evaluated according to the relevant criteria[8], after treatment, the waist activity basically returned to normal, the disappearance of waist and leg pain symptoms showed significant effect, the waist activity was improved after treatment and the obvious relief of low back pain symptoms was indicated as effective. If the above standard is not reached after treatment, it will be invalid. Functional Independence Measure (FIM)[9] and low back pain Oswestry Disability Index (ODI)[10] including the functional recovery of both groups was evaluated before and after 4 w of treatment using the FIM system with a score out of 10. Higher scores indicate better functional recovery. In addition, the degree of low back pain between the two groups was assessed using the ODI scale with a total score of 50. Higher scores are indicative of more severe low back pain. Muscle strength including the Tergumed® 710 spinal function test training system was employed to evaluate the muscle strength of the two groups prior to treatment initiation and 4 w post-treatment. The measurements taken included the maximum muscle strength of lumbar extension and flexion. Score of Japanese Orthopaedic Association (JOA)[11] and Visual Analog Scale (VAS)[12]: The JOA scale was utilized to evaluate the lumbar function of both groups before and 4 w after treatment, with a score out of 17 where higher scores denote better lumbar function. Additionally, pain severity in both groups was assessed using the VAS, with a total score in the range of 0-10, where higher scores indicate more severe pain. The measurement data were expressed by (mean±Standard Deviation (SD)), independent sample t-test was used for inter-group comparison, paired t-test was used for intra-group comparison, counting data was expressed as [n (%)], and inter-group comparison was tested by Chi-square (χ^2) test. The data were analyzed by Statistical Package for the Social Sciences (SPSS) 23.0 software, $p<0.05$. There was statistical difference. The overall effective rate of treatment was found to be 94.00 % in the test

group treated with pregabalin in combination with the SET suspension system, which was significantly higher than that of the control group (87.33 %) ($p<0.05$) as shown in Table 1. After 4 w of treatment, the FIM score of the two groups increased and the ODI score decreased, and the FIM score of the experimental group was higher than that of the control group, and the ODI score of the experimental group was lower than that of the control group as shown in Table 2. Table 3 shows an increase in both extensor and flexion muscle strength after a 4 w treatment period for both groups. However, the test group exhibited significantly higher extensor and flexion muscle strength compared to the control group ($p<0.05$). Following a 4 w treatment period, both groups had an increase in JOA score and a decrease in VAS score. However, the experimental group had a significantly higher JOA score and a significantly lower VAS score compared to the control group ($p<0.05$) as shown in Table 4. LDH is an important cause of low back pain in the middle-aged and elderly, but its pathogenesis is still unclear, mainly because the lumbar vertebrae and intervertebral disc of the patients have degenerative changes with the increase of age, their fibrous annulus is ruptured and the nucleus pulposus tissue protrudes or protrudes in the spinal canal, which causes certain compression or stimulation to the adjacent spinal nerve roots, and then produces low back pain. LDH-induced low back pain has a significant impact on the daily lives of patients[13]; thus, improving the treatment of LDH-induced low back pain is extremely necessary. Pregabalin is a frequently prescribed medication for the treatment of low back pain associated with LDH. As a new generation of drugs for the treatment of neuropathic pain, it can reduce the influx of calcium ions, increase the level of y-aminobutyric acid, avoid the release of norepinephrine, glutamate and substance P, control neuropathic pain, and help alleviate the symptoms associated with low back pain by inhibiting the activity of calcium channel subunit alpha (α) 28 protein[14]. However, pregabalin alone may not have a significant effect on rapidly improving muscle strength. The SET suspension system makes use of the closed chain movement under specific unstable conditions to fully activate the deep and superficial muscles of the patient's low back and strengthen the function of local stable muscles in the process of training to improve the coordination of lumbar movement, so as to adjust the relative position of lumbar bones, joints and muscles, reduce the compression and stimulation to the patient's nerve tissue and achieve the purpose of relieving low back pain[15]. The SET suspension system takes the gradual step-by-step mode to exercise, first carries on the weak chain test, then adjusts the exercise load of the patients with LDH low back pain in the open and closed chain mode to train the deep stable muscles in the spine, stimulate the mechanical receptors of the local muscles and promote the recovery of the normal muscle movement control mode of the patients, so as to strengthen the stability of the spine. Chen *et al.*[16] scholars believe that the SET therapy group had lower scores on the ODI and Roland-Morris dysfunction scale compared to the conventional massage group. Additionally, the SET therapy group had higher maximum extension and flexion strength of the psoas muscle than the conventional massage group. Research suggests that SET therapy can enhance the stability of the lumbar core, improve lumbar muscle strength and facilitate the recovery of lumbar function. The findings of this study demonstrate that the combined treatment of pregabalin and the SET suspension system resulted in a higher effective rate (94.00 %) compared to treatment with pregabalin alone in the control group (87.33 %) ($p<0.05$). The results of the 4 w treatment period showed an increase in FIM score and a decrease in ODI score in both the experimental and control groups. However, the experimental group showed a significantly higher FIM score and a significantly lower ODI score compared to the control group. Therefore, the study suggests that the combined treatment of pregabalin and SET suspension system can effectively alleviate the symptoms of low back pain and facilitate the recovery of lumbar function in patients with LDH-induced low back pain. According to the analysis of the reasons, the SET suspension system can improve the motor and sensory control ability, endurance and muscle strength of LDH patients with low back pain, so as to increase the body's ability to endure excessive tension and pressure, correct the dynamic imbalance of the body, improve the function of local stable muscles, relieve low back pain, delay lumbar degeneration and improve lumbar function. After a 4 w treatment period, both the experimental and control groups experienced an increase in their extensor and flexion muscle strength. However, the experimental group exhibited a significantly higher extensor and flexion muscle strength compared to the control

group. Following a 4 w treatment period, both groups experienced an increase in JOA score and a decrease in VAS score. However, the experimental group had a significantly higher JOA score and lower VAS score compared to the control group. It is suggested that pregabalin combined with SET suspension system can improve lumbar muscle strength, alleviate pain, and improve lumbar function in patients affected by LDH-induced low back pain. The leading factors may be that SET suspension system therapy enhances the motor ability of lateral limbs and trunk muscles by enhancing the feedback function between muscles and nerves, so as to improve the body's ability of control and balance in exercise and stimulate the coordination function of nerves and muscles. Combining pregabalin with other therapeutic interventions such as SET suspension system can improve the symptoms of low back pain, enhance lumbar muscle strength and promote the recovery of lumbar function in patients with LDH low back pain. This combination therapy approach may be more effective than using pregabalin alone for treating LDH low back pain. However, there are still some shortcomings in this study, such as the study time is short, the long-term effect of pregabalin combined with SET suspension system cannot be evaluated, so a long-term case analysis can be a valuable approach for improving the accuracy and reliability of research findings. To summarize, combining pregabalin with SET suspension system has been found to have a significant effect in treating LDH low back pain by reducing the degree of pain, improving lumbar muscle strength, and promoting the recovery of lumbar function. This treatment approach has the potential to be widely adopted as a safe and effective treatment option for patients with LDH-induced back pain.

TABLE 1: CLINICAL EFFICACY COMPARISON [n (%)]

Group	n	Significantly effective	Effective	Invalid	Effective rate
Test	150	81 (54.00)	60 (40.00)	9 (6.00)	141 (94.00)
Control	150	75 (50.00)	56 (37.33)	19 (12.67)	131 (87.33)
χ^2					3.939
p					0.047

TABLE 2: GROUP COMPARISON FOR FIM AND ODI SCORE

Group	n	FIM score		t	p	ODI score		t	p
		Before	After			Before	After		
Test	150	3.40±0.62	6.50±1.28	8.456	0.001	45.72±3.28	24.43±2.30	24.525	0.001
Control	150	3.33±0.61	4.76±0.78	5.325	0.001	45.61±3.20	30.62±2.63	22.461	0.001
χ^2		0.872	6.425			0.345	8.631		
p		0.320	0.001			0.769	0.001		

TABLE 3: GROUP COMPARISON OF MUSCLE STRENGTH

Group	n	Backward extension		t	p	Anteflexion		t	p
		Before	After			Before	After		
Test	150	0.45±0.06	0.69±0.10	10.4	0.001	0.63±0.09	0.84±0.13	8.41	0.001
Control	150	0.46±0.07	0.58±0.09	8.95	0.001	0.65±0.10	0.75±0.12	6.52	0.001
t		1.493	6.870			0.651	5.897		
p		0.139	0.001			0.343	0.001		

TABLE 4: GROUP COMPARISON OF JOA AND VAS SCORE

Group	n	JOA score		t	p	VAS score		t	p
		Before	After			Before	After		
Test	150	10.42±2.10	13.53±2.26	7.48	0.001	6.72±1.26	2.14±0.43	9.89	0.001
Control	150	10.49±2.17	12.64±2.18	5.83	0.001	6.80±1.22	3.25±0.65	8.54	0.001
t		0.341	4.345			0.139	5.562		
p		0.760	0.001			0.860	0.001		

Conflict of interests:

The authors declared no conflict of interests.

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