Rehabilitation and Intervention for Lumbar Disc Herniation in Young People

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Abstract. This study focuses on young people in China and divides them into groups according to their age, gender, occupation, disease duration, and other characteristics. According to the specific conditions of lumbar disc herniation in different groups of the young people, conservative and non-invasive treatment techniques (including pulse magnetic therapy, high-frequency electrotherapy, manipulative rehabilitation therapy, and hydrotherapy, etc.) were prioritized for the implementation of rehabilitation treatment, aiming to significantly improve or alleviate the prognosis of patients' dysfunction. For special populations engaged in professional sports, the treatment goal is to maximize the recovery of their pre-injury functional status. To scientifically determine the efficacy of the treatment, this study dynamically monitors and compares the patients' pain level and dysfunction level before, during and after the treatment, and assess their ability to perform activities of daily living (ADL), so as to comprehensively analyze the effectiveness of the application of different treatment techniques. Since the soft tissue repair ability is weak, or even no repair ability and most of the disease comes from long-term bad posture, strain injury, so during the treatment period may affect the recovery status due to the patient's physical condition, age, work and other complications, so the patient's daily life of the health education is also particularly important.

Keywords: Lumbar disc herniation; Pulsed magnetic therapy; High-frequency electrotherapy; Manipulative rehabilitation; Hydrotherapy.

1. Introduction

Lumbar disc herniation (LDH), is a series of symptoms and signs caused by rupture of the lumbar intervertebral disc annulus fibrosus and protrusion of the nucleus pulposus to compress or irritate the sciatic nerves on one or both sides. Based on epidemiological analysis both domestically and internationally, L4-5 and L5-S1 herniation account for more than 90% of the patients with lumbar disc herniation, with a higher incidence in the age range of 20 to 50 years old. Long term sedentary individuals are more susceptible to this disease[1]. The risk of L3-4 and L2-3 herniation increases with age in males compared to females. Predisposing factors include degenerative changes, occupation, smoking, psychological factors, medical injury, physical activity, as well as cold and obesity. Among most patients with lumbar disc herniation, L4-5 and L5-S1 herniations are more common in most lumbar disc herniations, followed by L2-3 herniations [2]. According to the site of onset and the type of herniation, they can be categorized as bulging, herniated, prolapsed and free. Patients with bulging and protruding types have no conscious symptoms, and their daily life and functional mobility are not affected. Patients with prolapsed and free type have typical radiating pain in the lower limbs, numbness in one or both lower limbs, hypesthesia, and obvious pain in the protruding area. Conservative treatment should be applied to the affected area of the patient, such as using instruments or manual traction therapy, and medication may also be used if necessary. Traction can enlarge the intervertebral space of the lumbar spine, allowing for varying degrees of retraction of the nucleus pulposus and reducing pain. At the same time, it relaxes the muscles around the lumbar spine, but it does not belong to the eradication of the treatment, such as not to take targeted treatment. The condition will recur year after year, affecting the patient's daily life activities. About 70%-80% of the patients will have a significant reduction in symptoms after treatment. The use of pulsed magnetic therapy can promote blood circulation in the muscles and soft tissues around the lumbar

region. This stage of treatment can help patients reduce pain, improve the function of the lumbar vertebrae, and correct bad posture.

2. Types and Mechanisms of Lumbar Disc Herniation Production

The bulging type of lumbar disc herniation is the earliest stage of disc degeneration, with relatively mild symptoms. Herniated type is the second stage of disc degeneration. The posterior longitudinal ligament is intact, the nucleus pulposus protrudes out of the spinal canal and directly presses the nerve root, and the nucleus pulposus is not yet completely free. The prolapsed type refers to a further breakdown of the posterior longitudinal ligament. The free nucleus pulposus completely breaks through the annulus fibrosus and the posterior longitudinal ligament and becomes fragmented and free in the spinal canal, and may move with the body position to compress the nerve root or the cauda equina. Different types of herniation, as well as treatments, vary from person to person.

The bulging type refers to the intervertebral disc in which the annulus fibrosus is not ruptured, the nucleus pulposus is bulging outward but not leaking out, and there is only limited bulging, and the compression on the nerve root is mild. Depending on the direction of disc compression, the nucleus pulposus will be compressed to different degrees, and different innervated areas will be involved, and this type is mostly seen in L4-5 and L5-S1. The main radicular symptoms of L4-5 are numbness or sensory loss on the lateral side of the calf, dorsal side of the foot, and weakness of dorsal extension of toes, while L5-S1 is mainly characterized by numbness of the outer ankle and the lateral side of the foot, and weakness of plantar flexion of the foot. Symptoms resolve in most 90% of patients after treatment.

Prolapsed type refers to the partial rupture of the fibrous ring, with the nucleus pulposus protruding but not completely free, and the nucleus pulposus directly irritates or presses the nerve root, which is also common in L4-5 and L5-S1, but L5-S1 is a high-incidence segment. L4-5 often presents with pain in the area of the buttocks, then the lateral thighs, then the anterior and lateral calves, and finally the dorsum of the foot (between the 1st and 2nd metatarsal bones) with radiating pain or numbness. The herniated type is characterized by weakness of dorsal extension of the foot (e.g., inability to walk on the toes) and possible diminished knee reflexes. Because the nucleus pulposus has herniated, but for nerve involvement, the pain is significantly reduced after treatment.

The prolapsed type not only has the corresponding symptoms of the herniated type, but may even be more severe. Restriction of plantarflexion of the ankle, loss of sensation on the lateral side of the foot, e.g., with compression of the cauda equina (central prolapse). Acute phase: numbness in the perineal area (saddle numbness), dysfunction of urinary and fecal functions (urinary retention/incontinence), and sexual dysfunction. The prolapsed nucleus pulposus may be displaced to different locations in the spinal canal, resulting in variable symptoms (e.g., alternating unilateral/bilateral lower extremity pain). Irritation of the cauda equina by fragments of the nucleus pulposus may cause severe low back pain with radiating pain in the lower extremities. The efficacy of conservative treatment for the prolapsed form is less than 50%, and the nucleus pulposus has involved the nerve root. Some patients may experience hyperalgesia and may require early surgical intervention if they develop foot drop, progressive loss of muscle strength, or cauda equina syndrome.

In the free type, because the nucleus pulposus has completely detached from its original position and entered the spinal canal, it may extensively compress the nerve root or cauda equina. L4-5 (L5 nerve root) and L5-S1 (S1 nerve root) are still the main segments involved, but we need to be highly vigilant about the risk of cauda equina compression. the pain area of the L5 nerve root compression (the original L4-5 protruding free) is the same as that of the L4-5, but it may also present with more severe symptoms. The free form is primarily characterized by weakness in dorsiflexion of the foot, inability to walk on tiptoe, decreased or absent knee reflexes, positive straight leg raise test/strengthening test, limited ankle motion, and loss of dorsiflexion of the toes. Treatment is less effective, the number of pain episodes decreases, but occasionally severe pain occurs, and muscle strength and sensory function need to be strengthened.

3. Treatment of Lumbar Disc Herniation

3.1. Pulsed Magnetic Therapy (PMT)

Patients with different types of herniated lumbar discs should be treated differently, starting with medication such as non-steroidal drugs for pain relief, targeted treatment by CT and MRI results, and a combination of various treatments, mainly including pulsed magnetic therapy, high-frequency electrotherapy, manipulative rehabilitation, and hydrotherapy. For patients with bulging lumbar disc herniation, the BY-1 type pulse magnetic therapy instrument is preferentially used for treatment [3]. Its frequency is a maximum 50Hz, once a day at the beginning, and gradually increases the number of times when the patient's treatment improves, three times for a course of 3 courses. For patients with herniated lumbar intervertebral disc herniation, because the volume of the nucleus pulposus of the herniated type is larger than that of the bulging type, thus compressing the annulus fibrosus to a high degree, and the annulus fibrosus will compress the sciatic nerves on one side or on both sides, the same pulse magnetic therapy instrument is used for treatment, and thus the type of nucleus pulposus herniation is more serious compared to that of the bulging type, and in the first treatment, according to the patients' conditions, heatless can be used for treatment, and it is gradually transited to low-heat , medium heat and high heat therapy, according to the treatment once a day, varying from person to person. For patients with low back and leg pain, this treatment technique can treat leg disorders at the same time. Whereas patients with detachment must be treated with no heat in pulsed magnetic therapy, patients with free form should be treated in the same way as patients with detachment.

3.2. High-frequency electrotherapy (HFET)

The focus of treatment with HF electrotherapy in patients with bulging is to reduce pain and maximize the prevention of outward bulging of the nucleus pulposus. Because high-frequency electricity has the effect of reducing swelling, analgesia, and antispasmodic as well as improving immunity, and promoting the increase of calcium ions, patients need to remove metal products from their bodies before treatment, and observe whether the patient's skin is broken and whether the skin is intact. The site of application will be sterilized, while the electrode sheet will be attached to the waist and legs. The frequency is adjusted to 30-300Hz of ultrashort waves, and the size of the dose will be selected according to the doctor's instructions. Observe the patient's response during treatment, and also treat leg disorders with warm heat, 5-10min per treatment, 2 times a day, 3 times a course of 3 treatments. Patients with protruding type can be treated with warm heat, after each treatment, the patient's family members should be instructed to observe the patient's sleep, to determine whether the dose is appropriate, and if the patient feels uncomfortable, the dose will be reduced in the next treatment, and the specific treatment method is the same as that of bulging type. Exfoliation type patients can use microcalorimetric therapy, each treatment 10-15min, observe whether there is edema, ask the patient whether there are contraindications to high-frequency electricity and metal foreign body, to avoid excessive fatigue of the patient, 1-2 times a day, 5-10 times for a course of treatment, the specific situation varies from person to person. Free-type patients in the premise that can already relieve pain, can be used without heat treatment, each treatment 5-10min, observe whether there is edema, inflammation, edema reduction can be changed to micro-heat treatment, 1-2 times a day, 4 times for a course of treatment. The treatment method is the same as above.

3.3. Manual Rehabilitation

Patients with bulging type can first use manipulative massage to loosen the muscles around the waist, such as erector spinae, lumbar square muscles, multifidus muscles, etc., or use warm therapy to relax the site of application, to prevent soft tissue injury during the treatment process, exacerbating the patient's pain. Unarmed traction should not be used to treat with violence, and it is necessary to understand the nature, scope, severity and prognosis of the pain. The parameters of traction should be based on the patient's pain, and the patient and his/her family members can be taught the methods

of self-traction and other people's traction when needed, and the rehabilitation of manipulation can be assisted by the use of devices, such as the Mckizen technique. Patients with protrusion are treated in the same way as those with bulging, but with less force, and a combination of high-frequency electrotherapy and mechanically assisted manipulation may be tried. Patients with prolapse have increased pain, mostly in the supine position where stretching is more common, and can be treated with high-frequency electrotherapy at the site of pain first. After treatment, wait a few minutes for manipulative traction to be applied. If the pain is still not relieved, medication is needed. Patients with free lumbar disc herniation are treated with fewer maneuvers and can be examined first for evaluation of the patient's straight leg raising test. However, this period is to reduce pain, correct the small joint disorder, and strengthen the surrounding muscles to prevent re-injury or re-dislocation.

3.4. Aquatherapy

Before hydrotherapy is performed, it is determined whether the patient has cardiopulmonary, motor, sensory and other complications, and the skin is observed to see if there is any broken skin and whether there is any infectious disease; the next step is to make pre-treatment regulations for the patient, such as the lung capacity is less than 1500ml, no food is allowed to be eaten 1-2h before the treatment, and the diaphragm is controlled, and so on. For disinfection, measures can be used chlorine, ultraviolet light, ozone, silver ion disinfection, adequate fixation of the patient's position, and setting around the auxiliary apparatus. Patients with bulging type can be placed in the pool during hydrotherapy with a therapeutic bed, and the therapeutic action can be judged according to the degree of pain. The water level should not be too high, as far as possible not to touch the untreated area, the water temperature should be 38-39 degrees, the patient as much as possible to expose the treatment area or wear easy to move clothing, while you can combine massage and traction for treatment training time is generally about 10-15min appropriate. Protruding type and bulging type of treatment are similar, try to maintain the function of the affected area, while reducing pain. The treatment method is the same as the bulging type, pay attention to observing the patient's response. The detachment type involves more neurosensory areas, so the symptoms involving the lower limbs are obvious, emphasizing walking in water to promote blood circulation in the lower limbs, and the treatment can be stopped if the pain is intolerable. Free type patients should not be active in the acute stage, because the nucleus pulposus fragments are ready to stimulate the nerve root leading to pain, you can use mechanical lifting to move the patient into the water for treatment, the length of the training is mainly 3 5min, the treatment is the same as dislodged type in the subacute stage.

4. Prevention and Intervention of Lumbar Disc Herniation

There are a variety of triggers for lumbar disc herniation, which may be directly related to age, smoking, alcoholism, diabetes, obesity, poor posture, and physical labor. People with milder forms of the disease do not realize that they have symptoms of lumbar disc herniation, which are similar to acute lumbar sprains, supraspinous and interspinous ligament injuries, lumbar dorsal fasciitis, lumbar spondylolisthesis, pelvic stenosis of the sciatic nerve and the pyriformis syndrome, the third lumbar transverse process syndrome, and sacroiliac dysfunction, and the characteristics of the lesion and the results of the tests need to be paid attention to when carrying out the differential diagnosis.

Bulging type is the mildest type of lumbar disc herniation, which mainly involves L3-4 and L4-5. L5-S1 pain is not obvious, and the patient can engage in general or larger physical activities, but occasionally there will be mild pain, which can be used to relax the erector spinae, psoas major, lumbar quadratus, and other peripheral lumbar muscles to relieve muscle tension. Most low back pain is directly related to climate change; try to avoid cold stimuli and pay attention to keep warm. For those who suffer from low back pain due to a sedentary lifestyle and poor posture, it is necessary to reduce the amount of work done to alleviate the irritating symptoms of low back pain and avoid strenuous activities. In the acute stage of bulging disc, avoid sitting, bending and weight bearing, and take short-term bed rest (≤3 days). After the symptoms are relieved, carry out core muscle group

exercise (such as plate support, small swallow fly) to enhance the stability of the lumbar spine. Patients of this type need long-term weight control, avoid strenuous exercise, maintain the natural curvature of the lumbar spine when sitting or standing, and try methods such as McKenzie, bridge and side bridge exercises.

Herniation type is a lighter type of lumbar disc herniation, the spinal cord segments involved are the same as those of bulging type, the pain is obvious, there are lumbar pain and irritation symptoms when resting in bed, which can be relieved after a few minutes, and the pain of climate change is obvious, so that patients can be engaged in light physical labor but are not suitable for larger physical activities, which may be combined with lumbar spine soft tissue injuries and disorders of lumbar vertebrae, and the correction of abnormal postures. If the patient is combined with scoliosis, orthopedic devices can be used appropriately for treatment, and high-frequency electrotherapy, hydrotherapy and manipulation rehabilitation can be carried out if necessary. In the acute stage, bed rest is needed, avoiding lumbar movement, and lumbar support can be used in the short term. During the period of symptomatic relief, targeted training can be carried out. L5 nerve root involvement can be strengthened through foot dorsiflexion training, thumb dorsal extension training, in S1 nerve root involvement can be carried out ankle pump training, to enhance the muscle strength of the peripheral muscles of the lumbar spine [4].

The prolapsed nucleus pulposus is prone to dislocation, which may lead to unilateral or bilateral lower extremity pain of varying degrees. Bed rest is required during the acute period, and a hardboard bed must be used to avoid bending and rotation, and lumbar support may be used for a short period of time (≤2 weeks). Non-steroidal anti-inflammatory drugs (e.g. celecoxib) have a pain-relieving effect, dehydrating agents (e.g. mannitol) can reduce nerve edema, and neurotrophic drugs (e.g. methylcobalamin) promote nerve repair; core training is needed for rehabilitation in the stabilization period, for example, movements such as plate support and small swallow fly (3 sets of 10 repetitions each per day) can enhance lumbar spine stability. Sitting for a long time, weight-bearing (>10kg) and frequent bending should be avoided as much as possible. Ergonomic cushions should be used to maintain the curvature of the lumbar spine when sitting or standing, and a medium-firm mattress should be chosen. Hydrotherapy and PNF techniques can be combined to promote sensory recovery in patients with reduced sensory function.Free herniation requires absolute bed rest in the acute phase (the first 2 weeks), in which a hardboard bed should be chosen to avoid bending, rotating, and sitting for a long time (≥20 hours per day); pharmacological interventions, such as nonsteroidal anti-inflammatory drugs (celecoxib and neurotrophic drugs (methylcobalamin) can be used at the same time; and short-term use of dehydrating agents (e.g., mannitol, as prescribed by the doctor) is indicated if neural edema occurs [5-6]. During the stabilization period (after 2 weeks), rehabilitation needs to focus on core training, and McKenzie therapy (e.g., gluteal bridges, small swallow flies) is recommended, with 3 sets of 10 repetitions per day. In addition, patients need to avoid sedentary activities (no more than 30 minutes per session) and weight-bearing (no more than 5 kg), and avoid massages and traction that may lead to aggravation of medullary displacement or nerve damage.50%-70% of patients can relieve their low back pain with the above symptoms, but rigorous evaluation is needed, and if the symptoms are not relieved, surgical treatment is recommended.

5. Treatment Recommendations and Measures for Lumbar Disc Herniation

After treatment, the outcome of bulging lumbar disc herniation was significantly improved, and pain scores were also greatly reduced, JOA dysfunction rating scores decreased, and function improved according to the VAS pain rating [7]. However, because this stage is aimed at young people, most of whom are aged 18-35 years old, most of them may suffer from this type of lumbar disc herniation due to spinal deformity, which may also be combined with multisegmental herniation and multisegmental lesions. Patients need to pay attention to long-term exercise in their living habits, the choice of daily necessities need to be adjusted accordingly for the pain, such as when lying down mattresses should be selected medium hardness, to ensure that the lumbar area is not overhanging, to

be able to insert the hand into the lumbar back of the gap is appropriate; stooping posture need to pay attention to the bending of the knees to keep the waist upright, to avoid direct large-scale stooping; can be referred to the index of the BMI form of body weight control to reduce the load on the lumbar spine; daily physical exercise, swimming can be chosen. In physical exercise, swimming (breaststroke) can be chosen 2-3 times a week, 30 minutes each time or crawl swimming, not recommended to exceed 30 minutes at the beginning; bar hanging twice a day, 30s each time or using their gravity traction to expand the intervertebral space.

The effect of herniated lumbar intervertebral disc herniation was improved during the treatment period, with negative cervical flexion test, significant improvement of pain, and improvement of muscle strength, endurance around the lumbar spine and stability of the lumbar spine; when the pain is severe, absolute bed rest is not less than 20h, and the lumbar support is used in a short period of time (not less than 2weeks); the pain of posture can be relieved by trying to lie down in prone position (each time for 5-10min, 3times a day); cold compresses are applied for each time for 10- 15min, 2h interval, pain relief can be switched to hot compresses (about 50℃, 30min/time); stable period can be used in core training (choose 3-4 movements per day, total duration of 25 minutes), of which the lateral bridge exercise needs to pay attention to start from the knee and forearm support, progression to the foot support (30 seconds/group × 10 groups); hip bridge exercise needs to be pelvis tilted back to lift the hips after the force (15 repetitions / group × 3-5 sets); McKenzie prone stretches in the elbows to support the upper body, deep breathing to maintain 2-3 minutes; backward walking training on a flat surface slow backward walking (10 minutes a day, pay attention to safety); the use of lumbar support to maintain lumbar curvature, sitting to maintain the low back straight (occupy the front 1 / 3 of the chair), sedentary every 30 minutes to get up and move; lying down on a flat lumbar pad thin pillows, padded pads under the knees, when lying on the side of the double knees between the pillows. Mattress selection of medium hardness (to reach into the gap in the back of the waist for the appropriate); lumbar neutral position, avoid excessive flexion; recommended breaststroke for weight control, 30min / times, 2-3 times a week, bar hanging 30s / times, 2 times a day, to avoid sedentary, weight-bearing greater than 5kg, frequent bending, strenuous aerobic.

The outcome of prolapsed lumbar disc herniation was improved with a significant reduction in VAS pain scores, a negative straight leg raising test, but also periods of intense pain, a significant reduction in the number of pain episodes, a reduction in Oswestry dysfunction index scores, and a significant improvement in JOA scores. Due to prolonged braking, the lumbar joint space was narrowed and the surrounding muscles were stiff. After treatment, the intervertebral space widened and muscle strength and endurance improved significantly. Daily treatment recommended a hardboard bed (2 layers of mattress), lying mainly flat, with intermittent prone lying (if prone lying is more comfortable). Avoid unilateral compression of the lumbar spine when lying on the side. Maintain natural curvature with a thin pillow on the lumbar region while lying in bed, and put soft cushions under the knees to relieve lumbar muscle tension. Try to finish eating, toileting, and reduce sitting and standing time during bed rest (≥20 hours of bed rest per day). Treatment recommendations for the herniated type can be used when pain is relieved by adopting the correct posture and avoiding sedentary behavior.

The effect of free lumbar disc herniation is improved to a lesser extent, with better recovery in adolescents under 25 years of age, with obvious establishment of scar tissue, but requiring absolute bed rest for 6-8 weeks, which varies from person to person. The effect of young people over 25 years of age has a poor prognosis, and daily treatment is recommended to be absolutely bedridden (≥20 hours of bed rest per day), with lying on the back mainly, keeping the lumbar spine in its natural curvature when lying on the back, and soft pillows under the knees, to alleviate muscular Tension, nursing care to avoid pressure sores, turn over regularly, avoid side lying compression of the lumbar spine. Reduce the time of sitting and standing, and relieve the pain in the same way as the above 3 types.

6. Conclusion

At present, there is no fast and effective treatment for patients with lumbar intervertebral disc herniation, and only some relief methods and drugs can be used. Since the soft tissue repair ability is weak, or even no repair ability and most of the disease comes from long-term bad posture, strain injury, so during the treatment period may affect the recovery status due to the patient's physical condition, age, work and other complications, so the patient's daily life of the health education is also particularly important. For patients with free lumbar disc herniation, better rehabilitation programs can be researched while reducing pain, and it is hoped that in the future, we can tend to disease drug research to achieve the purpose of shortening the course of the disease and reducing the pain of patients.

References

[1] Ucar, D., Duman, S., Bayram, Y., & Ucar, B. Y. (2021). Extruded disc herniations are experienced earlier by inactive young people in the high-tech gaming era. Journal of medicine and life, 14(3), 402–407. https://doi.org/10.25122/jml-2021-1059

[2] Pei, J., Yu, A., Geng, J., Liu, Y., Wang, L., Shi, J., Zhou, F., Zhang, T., Huang, P., & Cheng, X. (2023). The lumbar spinal endplate lesions grades and association with lumbar disc disorders, and lumbar bone mineral density in a middle-young general Chinese population. BMC musculoskeletal disorders, 24(1), 258. https://doi.org/10.1186/s12891-023-06379-w

[3] Zhang Yuhang. The effect of pulsed magnetic therapy combined with medium-frequency therapy and manual rehabilitation on lumbar spine function and pain severity in patients with lumbar disc herniation [J]. Chinese Science and Technology Journal Database (Citation Edition) Medicine and Health, 2025(3):061-064

[4] Gao Xiaoping, Liu Tong, Chen Hemu, Han Rui, Sun Zonglei, Zhao Kai. The Role of Lumbar and Abdominal Muscle Strength Training in Improving Lumbar Function and Preventing Recurrence in Patients with Lumbar Disc Herniation [J]. Chinese Journal of Clinical Rehabilitation, 2003, 7(23): 3220-3221

[5] Liu Xin, Wang Liangyi, Zhang Ning. Observation on the Efficacy of Whole-Body Hot Spring Hydrotherapy Combined with Lumbar and Back Muscle Exercises as an Adjuvant Treatment for Lumbar Disc Herniation [J]. Chinese Journal of Sanatorium Medicine, 2009, 18(1): 28-30

[6] Wu Yiqi, Zhang Ling, Liao Yang, Yang Wencheng, Lu Haichuan. Efficacy of pregabalin combined with celecoxib in the treatment of lumbar disc herniation patients during the perioperative period [J]. Clinical Rational Drug Use, 2025, 18(3):106-109

[7] Sun Lu, Li Aijing. A Study on the Correlation Between Rehabilitation Treatment Outcomes and Imaging Classification in Patients with Lumbar Disc Herniation [J]. Chinese Science and Technology Journal Database (Citation Edition) Medicine and Health, 2024(1):0053-0057