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# Application of MBSR Combined with Relaxation Training in the Perioperative Period of Interventional Therapy for Lumbar Disc Herniation

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**Abstract:** *Objective*: To explore the application effect of MBSR combined with relaxation training in the perioperative period of radiofrequency ablation combined with ozone interventional therapy for lumbar disc herniation. *Methods*: 90 patients with lumbar disc herniation who underwent radiofrequency ablation (RFA) combined with ozone interventional therapy in the Orthopedics and Traumatology Department of our hospital from January to December 2019 were included as research samples. They were randomly divided into two groups using a random number table method: the control group (45 cases) received routine perioperative nursing and health education; the experimental group (45 cases) received a comprehensive psychological intervention program consisting of MBSR combined with relaxation training in addition to the control group's treatment. Changes in pain perception (VAS), sleep quality (PSQI), psychological state (SAS/SDS), and life satisfaction (SWLS) were compared between the two groups before and after the intervention. *Results*: After the intervention, both groups showed a significant decrease in SAS and SDS scores ($P < 0.05$), with a greater decrease in the experimental group ($P < 0.05$); the experimental group had lower PSQI total scores and scores in each dimension compared to the control group ($P < 0.05$); the experimental group had a significantly lower VAS score ($3.56 \pm 0.88$) compared to the control group ($5.94 \pm 0.62$) ($P < 0.05$); the experimental group had a higher SWLS score ($28.59 \pm 5.61$) compared to the control group ($22.46 \pm 4.15$) ($P < 0.05$). *Conclusion*: MBSR combined with relaxation training can significantly optimize the perioperative psychological state of patients undergoing RFA combined with ozone interventional therapy, reduce pain sensitivity and stress responses, and simultaneously improve sleep quality and treatment satisfaction.

**Keywords:** MBSR; Radiofrequency ablation combined with ozone interventional therapy; Relaxation training;

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## 1. Introduction

Lumbar disc herniation (LDH) imposes a heavy burden on individuals, families, and society due to its highly recurrent nature [1–2]. Radio Frequency Ablation (RFA) is a commonly used minimally invasive interventional treatment for LDH. When combined with ozone injection, it not only achieves nucleus pulposus ablation and alleviates nerve compression but also exerts anti-inflammatory and analgesic effects, thereby aiding in the control of patients' clinical symptoms [3].

In current clinical practice, some middle-aged and elderly patients exhibit a triple cognitive-trust barrier chain:

(1) They lack a structured understanding of the pathological staging, progression trajectory, and the necessity for systematic treatment of their disease;

(2) Limited by their educational background and health literacy, they struggle to effectively interpret key decision-making parameters, such as the risk-benefit ratio of surgery and the survival rate of prostheses;

(3) Due to previous negative medical experiences or the spread of medical rumors, they develop defensive skepticism towards the professional judgment of healthcare teams [4].

Our team believes that this leads to inadequate preoperative psychological preparation and exacerbated intraoperative stress responses; indirectly causing a decline in treatment adherence, such as self-adjusting medication dosages and refusing rehabilitation training, ultimately resulting in clinical outcomes deviating from the expected therapeutic window. Psychological nursing interventions are particularly effective in addressing these issues.

Mindfulness-Based Stress Reduction (MBSR) is an emotion and stress management method based on mindfulness meditation, guided by the core principles of "being present" and "non-judgment" [1]. Mindfulness therapy combined with relaxation training, as an important component of psychological nursing interventions, helps alleviate intraoperative tension and stress responses, enhancing surgical satisfaction.

This study applied MBSR combined with relaxation training to the perioperative care of patients undergoing RFA combined with ozone intervention, yielding significant clinical effects. The findings are reported as follows to provide references for clinical nursing practitioners.

## 2. Materials and methods

### 2.1. General information

90 patients with lumbar disc herniation who underwent RFA combined with ozone intervention in the Orthopedics Department of our hospital from January 2021 to December 2021 were collected and randomly divided into an experimental group and a control group, with 45 patients in each group, according to the random number table method. Among them, the experimental group comprised 20 males and 25 females, with an average age of (49.82 ± 9.76) years; the conventional group comprised 22 males and 23 females, with an average age of (50.20 ± 9.56) years. There were no statistically significant differences in the baseline data between the two groups.

### 2.2. Inclusion and exclusion criteria

#### 2.2.1. Inclusion criteria

The inclusion criteria are as follows:

(1) Diagnostic criteria specified in the "Guidelines for the Diagnosis and Treatment of Lumbar Disc Herniation" issued by the Orthopaedic Branch of the Chinese Medical Association in 2020 [5];

(2) Aged between 18 and 80 years;
(3) Signed informed consent and actively cooperated with the treatment.

#### 2.2.2. Exclusion criteria

The exclusion criteria are as follows:

(1) Patients with severe cardiovascular and cerebrovascular diseases, severe infectious diseases, tumors, or other conditions that affect the assessment of nursing outcomes;
(2) Severe liver and kidney dysfunction, coagulation disorders, or blood system diseases;
(3) Severe spinal stenosis, cauda equina nerve injury, lumbar spondylolisthesis, etc.;
(4) Female patients planning pregnancy, in pregnancy, or during lactation;
(5) Patients with severe mental disorders or conditions such as blindness, deafness, or muteness that prevent normal communication.

#### 2.2.3. Dropout criteria

The dropout criteria are as follows:

(1) Poor patient compliance;
(2) Development of other major diseases during hospitalization;
(3) Withdrawal from the study for various subjective or objective reasons.

### 2.3. Intervention methods

#### 2.3.1. Experimental group

MBSR combined with relaxation training was adopted:

(1) A mindfulness-based stress reduction team, consisting of healthcare professionals with over 10 years of work experience, was trained by a professional psychology professor on topics such as "Methods and Applications of Mindfulness Therapy" and "Psychological Interventions for Patients Experiencing Stress Reactions," followed by relevant assessments;
(2) Specific nursing plan: MBSR (Mindfulness-Based Stress Reduction):
(i) Body scan: The responsible nurse instructs the patient to lie down flat, relax completely, or assume a "space traveler" lying position, breathe slowly, and feel the breath entering through the tip of the nose, traveling down the Ren Meridian to the lower Dan Tian (a point below the navel); then ascending from the tailbone along the Du Meridian to the Bai Hui point at the top of the head, allowing the patient to enter a state of utmost natural relaxation;
(ii) Sitting meditation: Guide the patient to sit comfortably, close their eyes gently, and engage in a one-minute abdominal relaxation exercise, adjusting their breathing autonomously. When pain arises, encourage the patient to observe the location and intensity of the pain, suggesting that the pain will dissipate with the breath. Spend 10–15 minutes daily on this, followed by a 1–2 minute rest before proceeding with other medical activities;
(iii) Walking meditation: Guide the patient to engage in "movement meditation," such as standing in the ward with feet parallel and shoulder-width apart, hands overlapping below the navel, closing their eyes and taking three deep breaths, then walking slowly, attentively feeling each movement while walking, and recording a journal;

(iv) Three-Minute breathing space technique: The responsible nurse instructs the patient to sit quietly, guiding them into a meditative state with full-body relaxation, viewing the body as an object of attention. Focus on the breathing movements to calm the mind, trying to perceive one's current thoughts and inner emotions. When negative emotions arise or a sense of tension and resistance exists, guide the patient to gently dispel them through deep breathing. Maintain an appropriate breathing frequency, performing the exercise for about 3 minutes each time, with no limit on the number of repetitions.

(v) Relaxation training:

(a) Breathing relaxation therapy: During exhalation, feel the breath descending from the Bai Hui point along the Ren Meridian to three inches below the navel; then from the Hui Yin point to the Yong Quan point; during inhalation, feel the breath ascending along the Foot Three Yang Meridians to the crown of the head via the Du Meridian;

(b) Music relaxation therapy: Play some Beethoven music through the ward television to uplift the patient's mood.

### 2.3.2. Control group

Adopt routine orthopedic perioperative nursing methods.

## 2.4. Observation indicators

### 2.4.1. Self-rating anxiety scale (SAS)

It was used to assess the level of anxiety, comprising 20 items rated on a 4-point scale ranging from 1 (none or very little time) to 4 (most or all of the time). The higher the score, the more severe the anxiety of the assessed individual.

### 2.4.2. Self-rating depression scale (SDS)

This scale is used to evaluate the degree of depression, with a total of 20 items rated on a 4-point scale from 1 (none or very little time) to 4 (most or all of the time). The total score is out of 100 points, with 53 points serving as the cutoff. The final score is positively correlated with the severity of depression; the higher the score, the more severe the depression.

### 2.4.3. Pittsburgh sleep quality index (PSQI)

The PSQI scale is used to evaluate patients' sleep quality over the past month, divided into seven dimensions. A higher score indicates poorer sleep quality.

### 2.4.4. Satisfaction with life scale (SWLS)

Comprising five items, a higher score indicates greater life satisfaction.

### 2.4.5. VAS score

Pain intensity was assessed using a standard Visual Analogue Scale (VAS), as detailed in **Table 1**. The VAS consisted of a 10-cm horizontal line anchored by the descriptors "No Pain" on the left end (0 cm) and "Worst Pain Imaginable" on the right end (10 cm). Patients were instructed to mark a point on the line that best represented their current pain level. The VAS score was determined by measuring the distance from the left anchor to the patient's mark, providing a continuous score ranging from 0 to 10.

**Table 1.** VAS pain score scale

| Feature | Description |
|---|---|
| Scale name | Visual Analogue Scale (VAS) for Pain |
| Format | A 10-cm (100-mm) horizontal line |
| Left anchor | 0 cm: "No Pain" |
| Right anchor | 10 cm: "Worst Pain Imaginable" |
| Scoring | Patients mark a point on the line to indicate their pain level. The score (0-10) is determined by measuring the distance in centimeters from the left anchor ("No Pain") to the mark. |

## 2.5. Statistical methods

Data were analyzed using Python software. A *P*-value less than 0.05 indicates statistical significance.

# 3. Results

## 3.1. Psychological status

There was a statistically significant difference in psychological status scores between the two groups of patients ($P < 0.05$), as shown in **Table 2**.

**Table 2.** Comparison of psychological status before and after intervention between the two groups (mean ± SD)

| Group | n | SAS | | t-value | *p*-value | SDS | | t-value | *p*-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Before | After | | | Before | After | | |
| Experimental group | 45 | 52.36 ± 3.28 | 31.29 ± 2.98 | -27.42 | < 0.001 | 59.63 ± 5.13 | 38.54 ± 2.65 | -29.63 | < 0.001 |
| Control group | 45 | 51.88 ± 3.86 | 44.33 ± 4.82 | -10.72 | < 0.001 | 58.79 ± 4.32 | 48.96 ± 4.11 | -17.25 | < 0.001 |
| t-value | | 0.636 | -15.432 | | | 0.840 | -14.294 | | |
| *p*-value | | 0.526 | < 0.001 | | | 0.403 | < 0.001 | | |

## 3.2. Sleep quality

A statistically significant difference ($P < 0.05$) was observed in the sleep quality scores between the two groups, as shown in **Table 3, Table 4**, and **Table 5**.

**Table 3.** Comparison of sleep quality scores between the two groups before and after intervention (mean ± SD)

| Group | n | Sleep onset time | | t-value | *p*-value | Sleep duration | | t-value | *p*-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Before | After | | | Before | After | | |
| Experimental group | 45 | 1.82 ± 0.45 | 1.13 ± 0.22 | 1.247 | < 0.001 | 2.56 ± 0.37 | 1.88 ± 0.21 | 3.457 | < 0.001 |
| Control group | 45 | 1.90 ± 0.35 | 1.65 ± 0.44 | 1.332 | < 0.001 | 2.49 ± 0.24 | 2.23 ± 0.79 | 1.004 | < 0.001 |
| t-value | | -0.941 | -7.094 | | | 1.066 | -2.871 | | |
| *p*-value | | 0.349 | < 0.001 | | | 0.289 | 0.005 | | |

**Table 4.** Comparison of sleep quality scores between the two groups before and after intervention (mean ± SD)

| Group | n | Sleep disorder score | | t-value | *p*-value | Sleep quality score | | t-value | *p*-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Before | After | | | Before | After | | |
| Experimental group | 45 | 1.98 ± 0.78 | 1.15 ± 0.59 | 1.260 | < 0.001 | 2.33 ± 0.17 | 1.29 ± 0.37 | 6.492 | < 0.001 |
| Control group | 45 | 1.88 ± 0.32 | 1.63 ± 0.44 | 1.741 | < 0.001 | 2.22 ± 0.41 | 1.87 ± 0.57 | 3.715 | < 0.001 |
| t-value | | 0.795 | -4.375 | | | 1.663 | -5.724 | | |
| *p*-value | | 0.428 | < 0.001 | | | 0.100 | < 0.001 | | |

**Table 5.** Comparison of sleep quality scores between the two groups before and after intervention (mean ± SD)

| Group | n | Sleep efficiency score | | t-value | *p*-value | Dysfunction score | | t-value | *p*-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Before | After | | | Before | After | | |
| Experimental group | 45 | 2.01 ± 0.63 | 1.19 ± 0.33 | 1.231 | < 0.001 | 2.45 ± 0.78 | 1.39 ± 0.74 | 4.571 | < 0.001 |
| Control group | 45 | 1.92 ± 0.45 | 1.62 ± 0.18 | 0.095 | < 0.001 | 2.39 ± 0.66 | 2.01 ± 0.37 | 0.225 | < 0.001 |
| t-value | | 0.779 | -7.674 | | | 0.394 | -5.024 | | |
| *p*-value | | 0.438 | < 0.001 | | | 0.694 | < 0.001 | | |

## 3.3. Life satisfaction scores

A statistically significant difference ($P < 0.05$) was observed in the life satisfaction scores between the two groups, as shown in **Table 6**.

**Table 6.** Comparison of SWLS scores (mean ± SD)

| Group | n | Before intervention | After intervention | t-value | *p*-value |
|---|---|---|---|---|---|
| Experimental group | 45 | 19.82 ± 3.59 | 28.59 ± 5.61 | -13.27 | < 0.001 |
| Control group | 45 | 20.79 ± 3.32 | 22.46 ± 4.15 | -4.71 | < 0.001 |
| t-value | | -1.331 | 5.892 | | |
| *p*-value | | 0.186 | < 0.001 | | |

## 3.4. VAS scores

A statistically significant difference ($P < 0.05$) was observed in the pain scores between the two groups, as shown in **Table 7**.

**Table 7.** Comparison of VAS scores between the two groups before and after intervention (mean ± SD)

| Group | n | Before intervention | After intervention | t-value | *p*-value |
|---|---|---|---|---|---|
| Experimental group | 45 | 8.36 ± 0.79 | 3.56 ± 0.88 | -28.15 | < 0.001 |
| Control group | 45 | 8.21 ± 0.86 | 5.94 ± 0.62 | -3.12 | 0.003 |
| t-value | | 0.861 | -14.829 | | |
| *p*-value | | 0.391 | < 0.001 | | |

## 4. Discussion

LDH is a degenerative spinal disease and a common cause of low back pain and leg pain. The etiology of this disease typically stems from the degeneration of the intervertebral disc. When the annulus fibrosus partially or completely ruptures, the protrusion of the nucleus pulposus can stimulate or compress the nerve roots, leading to pain and other symptoms. Patients often have a history of prolonged bending, labor, or extended periods of sitting or standing. Groups with a high prevalence of the disease include adolescents, athletes involved in throwing, high jump, long jump, etc., drivers, the elderly, pregnant women, and individuals with a family history.

Prompt medical attention is necessary if there are abnormalities in urination or defecation, or abnormal sensations in the saddle area. Diagnosis primarily relies on the patient's symptoms, physical signs, and imaging examinations such as magnetic resonance imaging. Non-surgical treatments are the mainstay for lumbar disc herniation, including lifestyle management, physical therapy, and medication. For patients with severe symptoms that do not respond to non-surgical treatments, minimally invasive spinal techniques or open surgery may be considered.

Pharmacological treatments typically include non-steroidal anti-inflammatory drugs, muscle relaxants, dehydrating agents, and short-term use of corticosteroids. As a degenerative condition, the prevention and management of LDH involve avoiding prolonged poor postures, such as bending over or sitting for extended periods, strengthening the lumbar muscles, maintaining a healthy weight, paying attention to dietary intake, avoiding excessive lifting of heavy objects, and undergoing regular medical check-ups for high-risk individuals to monitor disease progression [6]. According to the World Health Organization, approximately two-thirds of adults experience lower back and lower limb pain at some point in their lives, with about 85% of LDH patients also suffering from sciatica [7].

RFA is a commonly used minimally invasive interventional treatment method, widely applied due to its simplicity, minimal trauma, and rapid recovery. Ozone injection can oxidize polysaccharide proteins in the nucleus pulposus, effectively reducing inflammation and alleviating pain [8]. However, since the patient population is predominantly middle-aged and elderly, their tolerance decreases. The physical discomfort and pain caused by the disease, uncertainty about RFA treatment, anxiety and fear due to intraoperative puncture, and even a lack of sufficient trust in doctors can easily lead to irritability, anxiety, and other emotions, resulting in a fear of movement. This psychological state and physical discomfort interact, leading to sleep disturbances and forming a vicious cycle.

In such pathological states, the sympathetic-adrenal medullary axis shows excessive activation, prompting the postganglionic nerve fiber endings to release large amounts of catecholamine neurotransmitters such as norepinephrine, while the adrenal medulla simultaneously secretes supra-physiological concentrations of adrenaline into the bloodstream. This neuroendocrine cascade reaction mediates positive chronotropic/inotropic effects on the myocardium via β1 receptors, causing sinus tachycardia with palpitations in patients during surgery. Consequently, it triggers abnormal peripheral vascular constriction and respiratory muscle spasms via α1 receptors, manifesting as progressively worsening chest tightness and subjective dyspnea.

More notably, sustained activation of skeletal muscle β2 receptors induces continuous muscle fiber fasciculations, which can then progress to painful muscle tension. In cases of extreme stress, the aforementioned multisystem disorders can synergistically trigger acute anxiety attacks, with patients often reporting sensations of "suffocation" or "near-death panic." These prodromal symptoms of neurogenic shock significantly elevate the risk of intraoperative cardiovascular accidents, severely impacting the smooth progress of interventional treatment and postoperative outcomes [9]. Therefore, targeted professional psychological nursing protocols should be applied during the perioperative period.

Our research team posits that MBSR, as a core branch of third-generation cognitive-behavioral therapy, is theoretically grounded in structured attentional regulation training, such as focused meditation, somatic dynamic awareness, or yoga asanas. These practices guide patients to anchor cognitive resources in immediate internal and external stimulus experiences, thereby reconstructing neural plasticity pathways for emotion regulation.

This psychosomatic intervention model operates through two parallel mechanisms:

(1) By enhancing prefrontal cortex inhibitory control over the limbic system, lowering the threshold for negative emotional responses and achieving top-down regulation;

(2) By modulating vagal tone to suppress overactivation of the sympathetic-adrenal medullary axis, promoting physiological relaxation and achieving bottom-up feedback.

Quantitative analysis in this study revealed that the experimental group receiving integrated MBSR-relaxation training intervention demonstrated significant reductions in Self-Rating Anxiety Scale scores compared to baseline, with statistically significant intergroup differences in Self-Rating Depression Scale scores. These objective data provide evidence-based confirmation that this combined intervention effectively disrupts the vicious cycle of “anxiety-depression-pain.”

Study results indicated that sleep quality and life satisfaction scores in the experimental group were significantly higher than those in the control group ($P < 0.05$). These findings suggest that the combined nursing approach not only alleviates depressive symptoms but also improves sleep quality through meditation and breathing exercises, enabling patients to more easily enter deep sleep states. This further mitigates depressive states, gradually forming a positive feedback loop that encourages patients to more actively confront their illness and rehabilitation process [10].

Postoperative recovery of physical function, reintegration into social roles, and psychological state all influence patients’ quality of life. A positive psychological state facilitates active participation in rehabilitation and social activities, enhancing quality of life, which in turn promotes physical recovery, improves role and cognitive functioning, and even elevates pain thresholds.

## 5. Conclusion

In summary, the combination of MBSR and relaxation training can significantly improve the psychological state of patients undergoing intervertebral disc radiofrequency ablation combined with ozone intervention during the perioperative period, reduce intraoperative and postoperative pain perception and psychological stress responses, effectively enhance patients’ sleep quality, and increase postoperative satisfaction.

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## Disclosure statement

The authors declare no conflict of interest.

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