

# Correlation Analysis between the Morphological Changes of Paraspinal Muscles and the Grade of Lumbar Intervertebral Disc Degeneration in Patients with Lumbar Disc Herniation

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**Abstract:** Objective: To investigate the correlation and clinical significance between the morphological changes of paraspinal muscles and the grade of lumbar disc degeneration in patients with lumbar disc herniation. Methods: The clinical data of 100 patients with lumbar disc herniation who were treated in Xi'an Traditional Chinese Medicine Hospital from January 2018 to January 2021 were collected. And according to the patient's lumbar spine magnetic resonance imaging (MRI), the multifidus, erector spinae, and psoas major cross-sectional area (CSA) of the patient's lumbar L3-S1 intervertebral disc level were measured, and the morphological changes of the paraspinal muscles were summarized, and graded the degree of lumbar intervertebral disc degeneration according to Pfirrmann criteria (grade I-V). Pearson correlation analysis method was used to evaluate the correlation between paraspinal muscle morphology and lumbar disc degeneration grade. Results: The higher the degeneration grade of the L2-L3 intervertebral disc, the smaller the CSA of the psoas major. The higher the degeneration grade of the L3-L4 lumbar disc, the smaller the psoas CSA. The higher the grade of L4-L5 disc degeneration, the smaller the psoas major CSA. Conclusion: The area of the psoas major in patients with lumbar disc herniation is closely related to the grade of intervertebral disc degeneration, and the health of the paraspinal muscles is related to the lower back pain in patients with lumbar disc herniation. Clinically, the health of the paraspinal muscles can be evaluated according to the grade of degeneration. The severity of the disease can guide treatment and can make rehabilitation recommendations for the patient's prognosis.

## 1. Introduction

Lumbar disc herniation (LDH) is one of the more common spinal diseases in clinical practice,<sup>[1,2]</sup> The highest incidence is in people aged 30 to 50, with a male to female ratio of 2:1. Low back pain is a common health problem in life, and lumbar disc herniation is one of its common causes<sup>[3]</sup>. MRI has become the standard imaging modality for the detection of intervertebral disc lesions because of its multiplanar imaging capabilities, excellent spinal soft tissue contrast, and precise localization of disc changes<sup>[4]</sup>. At the same time MRI was used to determine the exact location and severity of muscle morphological changes<sup>[5]</sup>. Therefore, we chose to use MRI imaging to observe and measure the morphology of the paraspinal muscles and the grade of lumbar disc degeneration. Studies have confirmed that low back pain is closely related to paraspinal muscle atrophy<sup>[6]</sup>, and the changes in the cross-sectional area of paraspinal muscles have a certain correlation with lumbar disc degeneration<sup>[7]</sup>, but few people have studied the paravertebral disc in patients with lumbar disc herniation. Therefore, this paper mainly discusses the relationship between the morphological changes of paraspinal muscles (multifidus, erector spinae, psoas major) and the grade of lumbar intervertebral disc degeneration in patients with chronic nonspecific low back pain. sex. The report

is as follows.

The clinical data of 100 patients with lumbar intervertebral disc herniation who were treated in the Spine Ward of the Department of Orthopedics and Traumatology of Xi'an Traditional Chinese Medicine Hospital from January 2018 to July 2021 were collected for retrospective analysis, including 50 males and 50 females; aged 19- 55 years old, disease duration 1-360 months. Inclusion criteria: ① Age 18-60 years old; ② A patient diagnosed with lumbar disc herniation; ③ No previous lumbar surgery; ④ The time interval between admission and completion of lumbar spine MRI is less than 1 week; L4, L5, S1 segments. Exclusion criteria: ① patients with intervertebral canal stenosis; ② patients with previous lumbar and pelvic surgery; ③ patients with degenerative scoliosis;

## **2. Materials and Methods**

### **2.1 Observation Indicators**

The basic conditions of the patients were recorded, including gender, age, course of disease, and cross-sectional area of the paraspinal muscles on the left and right sides. The MRI of the patients on admission was recorded, and the MRI of the enrolled patients was evaluated by a number of experienced orthopaedic surgeons. The degree of lumbar intervertebral disc degeneration was graded according to the Pfirrmann standard, and the cross-sectional area of the multi-segment paraspinal muscle was applied using INFINITT. The software obtained quantitative measurements of the multifidus, erector spinae, and psoas major muscles located on both sides of the spinous process at the L3, L4, L5, and S1 superior endplate planes from axial T2-weighted images, and specified the innermost layer of each muscle. The deep fascia serves as the boundary for measuring the cross-sectional area of the muscle.

### **2.2 Statistical Analysis**

Statistical analysis was performed using SPSS 22.0 software. Data conforming to normal distribution were expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), and the correlation between paraspinal muscle morphology and lumbar intervertebral disc degeneration grade was evaluated by Pearson correlation analysis.  $P < 0.05$  was regarded as a statistically significant difference.

## **3. Results**

### **3.1 Correlation Analysis between Grades of L2-L3 Intervertebral Disc Degeneration and Muscle Cross-Sectional Area**

The Pearson correlation analysis in Table 1 shows that the grade of intervertebral disc degeneration in the L2-L3 segment is significantly negatively correlated with the CSA of the left psoas major and the CSA of the right psoas major ( $p < 0.05$ ), indicating that the degeneration grade of the L2-L3 intervertebral disc has a significant negative correlation. The higher the CSA, the lower the left psoas CSA and the right psoas CSA. ( $p > 0.05$ )

### **3.2 Correlation Analysis of Vertebral Degeneration Grade and Muscle Cross-Sectional Area of L3-L4 Segment**

The Pearson correlation analysis in Table 2 shows that the grade of lumbar intervertebral disc degeneration in the L3-L4 segment is significantly negatively correlated with the CSA of the left psoas major muscle ( $p < 0.05$ ), indicating that the higher the degeneration grade of the L3-L4 intervertebral disc, the larger the left lumbar muscle. The lower the muscle CSA.

Table 1 Correlation Analysis Of Degeneration Grade and Muscle Cross-Sectional Area of L4-L5 Segment

	CSA (mean ± standard deviation)	P
Left Multifidus CSA (mm <sup>2</sup> )	288.18±214.94	0.994
Left erector spinae CSA (mm <sup>2</sup> )	1755.48±489.26	0.058
Left psoas CSA (mm <sup>2</sup> )	604.67±306.54	0.007
Right Multifidus CSA (mm <sup>2</sup> )	258.54±73.02	0.761
Right erector spinae CSA (mm <sup>2</sup> )	1715.08±501.43	0.514
Right psoas CSA (mm <sup>2</sup> )	615.89±330.05	0.006

Table 2 Correlation between Grade of L3-L4 Disc Degeneration and Muscle Cross-Sectional Area

	CSA (mean ± standard deviation)	P
Left Multifidus CSA (mm <sup>2</sup> )	322.58±124.7	0.992
Left erector spinae CSA (mm <sup>2</sup> )	1777.15±901.35	0.026
Left psoas CSA (mm <sup>2</sup> )	886.85±497.66	0.026
Right Multifidus CSA (mm <sup>2</sup> )	328.31±161.1	0.68
Right erector spinae CSA (mm <sup>2</sup> )	1591.58±461.23	0.184
Right psoas CSA (mm <sup>2</sup> )	887.66±349.94	0.381

#### 4. Conclusion

There are bound to be problems in the mechanics of the spine and muscle tissue in patients with lumbar disc herniation, and in the process of lumbar disc degeneration, the intervertebral disc undergoes complex biochemical changes that reduce the ability of the loaded disc to retain water and change the height of the intervertebral disc, which may affect other spinal structures. The behavior of muscles, ligaments, and joints can cause symptoms of low back pain.

The psoas is a hip flexor, but unlike other lower extremity muscles, the psoas originates from the lumbar spine and is the largest muscle in cross-section below the lumbar spine. Emotional and stress disorders caused by low back pain. In this study, the cross-sectional area of the psoas major in patients with severe lumbar disc herniation was lower than that in patients with mild to moderate lumbar disc degeneration, and there was a significant relationship between the cross-sectional area of the psoas major and the grade of lumbar disc degeneration. Therefore, the cross-sectional area of the psoas major muscle can be regarded as a relevant factor for disc degeneration in patients with lumbar disc herniation.

In conclusion, there is a close correlation between the atrophy of the psoas major and the grade of lumbar disc degeneration in the morphological changes of the paraspinal muscles in patients with lumbar disc herniation. This study also has limitations. Affected by the cross-sectional study, although the results show the correlation between the shape of the psoas major and the grade of lumbar intervertebral disc degeneration, the causal relationship between the two cannot be clearly defined, that is, the abnormal shape of the paraspinal muscles causes the. The causal relationship between lumbar intervertebral disc degeneration or paraspinal muscle dysfunction caused by lumbar intervertebral disc degeneration requires further research to understand whether there is a correlation between lumbar degenerative disc disease and paraspinal muscle atrophy, which may provide more information. Greater knowledge about the etiology of disease and associated pain-generating mechanisms, and help discover new treatment options

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