INTERVERTEBRAL DISC HERNIATION: CLINICAL AND STATISTICAL ANALYSIS

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ABSTRACT

A clinical and statistical analysis of 20 patients with intervertebral disc herniations is presented. The mean age was 50.9 ± 10.3 years. Women predominated among those examined — 13 patients (65%). The lumbar spine was most frequently affected — 15 cases (75%). Patients were divided into two groups: conservative treatment (n=15) and surgical treatment (n=5). The mean maximum hernia size in the conservative group was 6.7 ± 2.3 mm, in the surgical group — 10.0 ± 2.9 mm; the difference showed a clinical trend but did not reach statistical significance (p=0.064). A positive correlation was identified between hernia size and treatment method (r=0.51; p=0.022), as well as between the severity of the clinical syndrome and the choice of treatment strategy (r=0.46; p=0.041). The findings confirm that hernia size and the degree of neurological deficit are key criteria in determining the treatment approach.

KEYWORDS: *intervertebral disc herniation, lumbar spine, cervical spine, radicular syndrome, conservative treatment, surgical treatment, Student's t-test, correlation analysis, spinal MRI*

Introduction

Intervertebral disc herniations are among the most common degenerative-dystrophic diseases of the spine and remain one of the leading causes of back pain, limited physical activity, and temporary disability in working-age individuals. The clinical significance of this condition is determined not only by the intensity of pain but also by the risk of persistent neurological deficit.

The intervertebral disc serves a shock-absorbing function and consists of the annulus fibrosus and nucleus pulposus. As degenerative changes progress, the elasticity

and strength of the annulus fibrosus decrease, creating conditions for disc material to migrate beyond anatomical boundaries and form a herniation. Depending on the direction and degree of protrusion, the herniation may exert mechanical and chemical pressure on nerve roots and the spinal cord.

The lumbar spine is most frequently affected, particularly segments L4-L5 and L5-S1, due to high axial loading and a wide range of motion. The cervical spine is affected less often, but its involvement may produce pronounced radicular pain, sensory disturbances, and motor impairment. Diagnosis is based on a combination of clinical neurological examination and magnetic resonance imaging, which allows precise determination of the location, size, and extent of the herniation.

Treatment strategy is determined individually. Conservative treatment includes pharmacotherapy, physiotherapy, and therapeutic exercise, while surgical intervention is indicated for progressive neurological deficit, severe pain, large herniations, and pelvic organ dysfunction. In this context, the study of clinical and statistical features of patients with intervertebral disc herniations remains highly relevant.

The present study aimed to conduct a comparative clinical and statistical analysis of two patient groups — conservative and surgical treatment — using Student's t-test and Pearson correlation analysis to identify objective predictors of treatment selection.

Materials and Methods

Study Design

The study was conducted as a retrospective comparative clinical and statistical analysis. All patients were divided into two groups based on the treatment method applied: conservative and surgical. The observation period was 2024.

Study Population

The study included 20 patients aged 29 to 72 years (mean age 50.9 ± 10.3 years, median 52.5 years). Among them: women — 13 patients (65%), men — 7 patients (35%). All patients were divided into two groups:

Conservative group (n=15): patients who received pharmacotherapy, physiotherapy, and therapeutic exercise. Mean age — 49.8 ± 15.4 years.

Surgical group (n=5): patients who underwent surgical intervention. Mean age — 54.0 ± 8.4 years.

Inclusion Criteria

- verified diagnosis of intervertebral disc herniation by MRI;
- presence of clinical neurological syndromes corresponding to the level of involvement;
- sufficient completeness of medical documentation for analysis;
- age over 18 years.

Exclusion Criteria

- acute traumatic spinal injuries;
- oncological and inflammatory spinal lesions;
- insufficient medical documentation for analysis.

Methodology

For each patient, the following data were recorded: sex, age, location and number of affected levels, maximum hernia size by MRI, clinical syndrome, and treatment method. Clinical syndromes were coded: 0 — reflex syndrome, 1 — radicular syndrome, 2 — complicated forms (monoparesis, pelvic organ dysfunction, significant postural disturbance). Treatment was coded: 0 — conservative, 1 — surgical.

Statistical Analysis

Mean values (M) and standard deviation (SD) were calculated for quantitative indicators. Student's t-test for independent samples was used to compare the two groups; Welch's correction was applied for unequal variances. Correlation analysis was performed using Pearson's coefficient (r). Differences were considered statistically significant at $p < 0.05$. The coefficient of variation (CV%) was calculated to assess data variability.

Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. The use of anonymised medical records was carried out in compliance with bioethical requirements. All patients had previously given informed consent to examination and treatment.

Results

The study yielded quantitative and qualitative indicators characterising the clinical features of both patient groups. The analysis was conducted across the following parameters: sex and age composition, lesion location, hernia size, clinical syndromes, and treatment approach.

1. Comparative Analysis of Hernia Size

The mean maximum hernia size differed markedly between groups:

– Conservative group: 6.7 ± 2.3 mm

– Surgical group: 10.0 ± 2.9 mm

The difference between groups was 3.3 mm. Student's t-test yielded: t = 2.27, df ≈ 6, p = 0.064 — a consistent trend approaching statistical significance was identified. The limited size of the surgical group (n=5) is the primary factor reducing statistical power. All three herniations ≥10 mm (13 mm, 11 mm, 12 mm) were found in the surgical group, while the maximum size in the conservative group did not exceed 10 mm.

Parameter	Conservative (n=15)	Surgical (n=5)	p
Mean age (years)	49.8 ± 15.4	54.0 ± 8.4	> 0.05
Hernia size (mm)	6.7 ± 2.3	10.0 ± 2.9	0.064

Table 1. Comparative characteristics of treatment groups

2. Comparative Analysis of Age

The mean age in the conservative group was 49.8 ± 15.4 years, in the surgical group — 54.0 ± 8.4 years. Statistical comparison yielded: $t = 0.77$, $df \approx 13$, $p > 0.05$. No statistically significant age difference was found between groups, indicating that age alone was not a decisive criterion for treatment selection in this sample.

3. Correlation Analysis

Pearson correlation analysis revealed the following associations:

- between hernia size and treatment method: $r = 0.51$ (moderate positive correlation; $p = 0.022$);
- between severity of clinical syndrome and treatment method: $r = 0.46$ (moderate positive correlation; $p = 0.041$);
- between age and hernia size: $r = 0.20$ (weak correlation; $p > 0.05$).

These findings indicate that larger hernia size and more severe clinical syndrome significantly correlate with the choice of surgical treatment. The association between age and hernia size was not statistically significant.

4. Variability of Indicators

Analysis of variability in hernia size and age between groups yielded the following coefficients of variation:

- Hernia size — conservative group: CV = 34%; surgical group: CV = 29%.
- Age — conservative group: CV = 31%; surgical group: CV = 16%.

The higher variability in hernia size within the conservative group reflects its heterogeneous composition, ranging from small herniations (3–5 mm) to individual cases of up to 10 mm with moderate clinical symptoms. The lower age variability in the surgical group (CV=16%) indicates relative homogeneity of this subgroup by age.

5. Lesion Location and Multilevel Involvement

The lumbar spine was the most common site of involvement: 15 cases (75%). The cervical spine was affected in 4 patients (20%), combined involvement in 1 case (5%). The most frequently affected segments were L4-L5 (10 cases), L5-S1 (7 cases), and L3-

L4 (6 cases). Multilevel involvement was found in 12 patients (60%), indicating the systemic degenerative nature of the process.

6. Clinical Syndromes

Radicular syndrome was the predominant clinical presentation — 12 patients (60%). Reflex syndrome was noted in 5 patients (25%). Complicated forms (monoparesis, postural disturbance, pelvic organ dysfunction) — in 3 patients (15%). All patients with complicated forms were assigned to the surgical group or intensive conservative therapy.

Clinical Syndrome	n	%
Reflex	5	25%
Radicular	12	60%
Complicated	3	15%

Table 2. Distribution of clinical syndromes

Summary

The most informative predictors of surgical treatment were hernia size (r=0.51; p=0.022) and severity of clinical syndrome (r=0.46; p=0.041). Patient age did not exert a statistically significant effect on treatment selection in this sample. The mean hernia size in the surgical group exceeded that in the conservative group by 3.3 mm, confirming the clinical importance of this parameter.

Discussion

The results obtained are broadly consistent with current understanding of the factors determining treatment choice in intervertebral disc herniation. The identified moderate positive correlation between hernia size and surgical intervention (r=0.51; p=0.022) confirms that the volume of disc protrusion is one of the key quantitative criteria when deciding on surgical treatment.

The correlation between clinical syndrome severity and treatment method

(r=0.46; p=0.041) is consistent with the literature indicating that the presence of motor deficit, monoparesis, and pelvic organ dysfunction serves as the primary indication for surgery regardless of hernia size. This highlights the primacy of clinical presentation over neuroimaging data alone. The absence of statistically significant age differences between groups (p>0.05) suggests that age per se is not a decisive criterion for treatment selection in this sample. This is consistent with current clinical guidelines, in which biological age and general somatic status are considered auxiliary factors in assessing surgical risk. The dominance of lumbar localisation (75%) and the high frequency of L4-L5 and L5-S1 involvement reflect the biomechanical characteristics of the lower spine. Multilevel involvement in 60% of patients indicates the systemic degenerative nature of the process, necessitating comprehensive MRI assessment of the entire spine.

The limitations of this study should be acknowledged. The sample size (n=20) and particularly the surgical subgroup (n=5) are relatively small, reducing statistical power. The difference in hernia size between groups (t=2.27; p=0.064) did not reach p<0.05, although it is clinically substantial. Expanding the sample in future studies will allow more rigorous statistical conclusions.

Nevertheless, the findings reflect real clinical practice and confirm the rationale for applying objective quantitative criteria — primarily hernia size and degree of neurological deficit — when deciding on treatment approach.

Conclusion. The clinical and statistical analysis of 20 patients with intervertebral disc herniations identified several significant patterns. Women predominated (65%) and the mean age was 50.9 years. The lumbar spine was the leading site of involvement (75%), primarily at the L4-L5 and L5-S1 levels. Multilevel involvement was found in 60% of patients. Comparative analysis of the two groups showed that mean maximum hernia size was markedly higher in the surgical group (10.0 ± 2.9 mm vs 6.7 ± 2.3 mm). Correlation analysis revealed a significant association between hernia size and treatment method (r=0.51; p=0.022), and between clinical syndrome severity and surgical strategy

(r=0.46; p=0.041). Patient age did not significantly influence treatment selection (p>0.05), confirming the priority of clinical and neuroimaging data over demographic characteristics in treatment planning. Future research should focus on expanding the sample, incorporating long-term outcomes, and developing standardised quantitative threshold criteria for surgical intervention indications.

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