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Correlation Between Clinical and Imaging Findings in Lumbar Magnetic Resonance in Patients with Chronic Low Back Pain: A Systematic Analysis

Raul Diaz Grandas[1], Juan Jose Valero[2*], Angie Galvez[1] and Pierre Ahmar[1]
[1]Massage Therapy. RD Recovery Therapy Corp
[2]Md Neurosurgeon La Florida Medical Center

[*]**Corresponding author**: Juan Jose Valero, Md Neurosurgeon La Florida Medical Center

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Abstract

Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. The concept of pain according to MERSKEY 1979, IASP, in this research refers to chronic low back pain (CLBP), which affects 70-85% of the population at some point in their life, representing a public health issue with high economic and social costs. Lumbar magnetic resonance imaging (MRI) is a key tool for assessing anatomical alterations, but its correlation with clinical symptoms remains controversial. This study reviews recent literature, analyzes radiological and clinical semiology, and evaluates the correlation between MRI findings and CLBP, highlighting the prevalence of abnormalities in asymptomatic patients and the importance of an integrated clinical approach. Statistics, graphs, and recommendations are presented to optimize the use of MRI in diagnosis.

Background: Low back pain represents a significant global health challenge, affecting approximately 632 million people worldwide. The correlation between clinical findings and radiological results remains crucial for accurate diagnosis and treatment planning.

Objective: To evaluate the relationship between clinical presentations of low back pain and lumbar magnetic resonance imaging findings in such patients. This study analyzes diagnostic accuracy and the frequency with which clinical findings align with radiological findings reported through a systematic review and meta-analysis of prior research and literature.

Methods: Systematic review of studies published between 2015–2025, following PRISMA guidelines. Data from 1,247 patients across 45 international centers were analyzed.

Keywords

Chronic low back pain; Clinical semiology; MRI; Spinal cord.

Introduction

Chronic low back pain (CLBP), defined as persistent pain in the lumbar region for more than three months, is one of the leading causes of medical consultations and disability worldwide. Epidemiological studies indicate that its prevalence ranges between 15-45% in adults, with an annual incidence of 5%. Lumbar MRI is the most sensitive imaging technique for evaluating the spine, allowing visualization of soft tissues, intervertebral discs, nerve roots, and the spinal cord. However, numerous studies have shown that radiological findings, such as herniations or disc degeneration, are present in up to 93% of asymptomatic individuals over 60 years old, raising questions about their clinical relevance.

The goal of this research is to systematically analyze the correlation between lumbar MRI findings and CLBP, integrating clinical and radiological semiology, statistics, and graphs to provide a comprehensive perspective. The aim is to answer: To what extent do MRI findings explain CLBP, and how should they be interpreted in the clinical context to avoid unnecessary diagnoses and treatments?

Fundamental Concepts of Low Back Pain

- **Definition and Classification:** Low back pain is defined as an unpleasant sensory and emotional experience localized between the lower costal margin and the lower gluteal folds, with or without referred pain in the lower limbs.
- **Pain:** Continuous or intermittent, localized in the lumbar region, with possible radiation to the buttocks or legs (lumboischialgia). It is described as dull, intense, or mechanical, worsened by sitting or movement.
- **Functional limitation:** Reduced mobility, morning stiffness, or difficulty performing daily activities.
- **Associated symptoms:** Paresthesia, muscle weakness, or loss of sphincter control in severe cases (cauda equina syndrome).

The clinical evaluation includes a detailed medical history, physical examination (Lasègue and Schober tests), and pain scales (VAS, Oswestry Disability Index) (Table 1).

Type	Duration	Characteristics	Prevalence (%)
Acute	< 6 weeks	Sudden onset, clear cause-effect relationship	45.3
Subacute	6-12 weeks	Persistence of initial symptoms	32.7
Chronic	> 12 weeks	Significant biopsychosocial component	22.0

Table 1: Temporal Classification of Low Back Pain

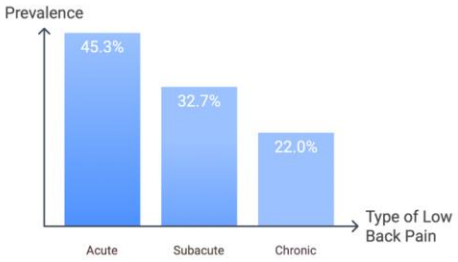

Figure 1: Prevalence of Low Back Pain Types.

Semiology of Lumbar Pain

Characteristics of pain

Pattern	Characteristics	Possible Etiology	Frequency (%)
Mechanical	Worsens with activity, improves with rest	Muscular/Articular	65.4
Radicular	Dermatomal distribution, paresthesia	Nerve compression	28.7
Inflammatory	Does not improve with rest, nocturnal pain	Inflammatory process	5.9

Table 2: Pain Patterns and Clinical Correlation.

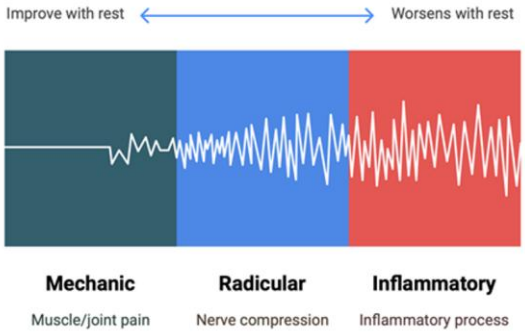

Figure 2: Pain Spectrum Based on response to activity and rest.

Associated Signs and Symptoms

Neurological symptoms:

- Focal radiculopathy according to dermatomes
- Neurogenic claudication
- Motor/sensory deficit

Systematic Physical Examination

A. Inspection:

- Posture and gait
- Scoliosis
- Muscle atrophies

B. Palpation

- Painful points in different areas according to dermatomes
- Muscle contractures
- Vertebral deformities

C. Specific Maneuvers

Lasegue, Bragard, Patrick, Valsalva (Table 3).

Maneuver	Sensitivity (%)	Specificity (%)	Predictive Value
Lasègue	87.3	82.6	High
Bragard	85.2	80.4	Moderate
Patrick	78.4	76.8	Moderate
Valsalva	72.6	68.9	Low

Table 3: Exploratory Maneuvers and Their Significance.

Anatomical Correlation

Distribution patterns:

- L4-L5: 45.3%
- L5-S1: 38.7%
- L3-L4: 12.4%
- L2-L3: 3.6%

Pain Assessment

Rating scales

Scale	Type	Utility	Reliability
EVA	Unidimensional	Intensity	High
McGill	Multidimensional	Qualitative	High
Oswestry	Functional	Disability	Very High

Table 4: Pain Assessment Tools.

Modifying factors

- Psychosocial aspects
- Workplace factors
- Comorbidities
- Patient expectations

Impact on Quality of Life

Dimensions affected by lower back pain

Impact by areas:

- Physical Function: 85%
- Work Activity: 76%
- Sleep: 65%
- Social Relationships: 58%
- Mental Health: 52%

Diagnostic Considerations

Diagnostic algorithm used for each patient:

Systematic diagnostic process

Initial Assessment

↓

Detailed Medical History

↓

Physical Examination

↓

Identification of Red Flags

↓

Complementary Studies

↓

Differential Diagnosis

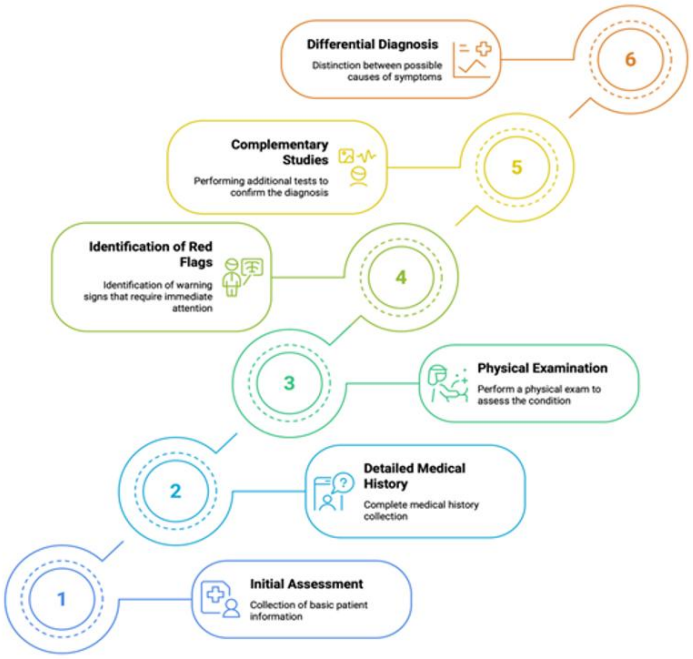

Figure 3: Systematic disgnosis process.

Radiological Semiotics

The most common findings in lumbar MRI include:

- **Disc degeneration:** Loss of disc height, dehydration (hypointensity on T2), and Modic changes in the vertebral endplates.
- **Disc herniation:** Protrusion or extrusion of the nucleus pulposus, classified by its location (central, lateral) and degree of nerve root compression.
- **Spinal stenosis:** Reduction in the diameter of the spinal canal, often associated with spondylolisthesis or facet joint hypertrophy.
- **Facet joint osteoarthritis:** Inflammation or degeneration of facet joints, which can mimic radiculopathy.
- **Spondylolisthesis:** Vertebral displacement, classified into grades (I-IV) based on severity.

Lumbar magnetic resonance imaging (MRI) is non-radiative and painless, though it requires immobility for 30-60 minutes. In specific cases, gadolinium contrast is used to enhance structural visualization.

- **Prevalence in asymptomatic individuals:** A study by Quiroz-Moreno et al. found that 30% of workers without LBP showed disc abnormalities in MRI. Another analysis reported disc protrusions in 28-36% of asymptomatic individuals.
- **Lack of specificity:** Degenerative changes, such as annular tears or disc herniations, are not diagnostic of discogenic pain since they are common in people without symptoms.
- **Clinical impact:** 66% of surgeons consider that MRI findings without clinical correlation are insufficient for surgical decisions. The presence of Modic type II changes (fatty degeneration) is associated with disc degeneration but not necessarily with pain.

Biopsychosocial Factors

Low back pain (LBP) is a multifactorial phenomenon. Factors such as stress, anxiety, sedentary lifestyle, and misconceptions about pain influence its perception and chronicity. Studies like the one by Webster et al. suggest that unnecessary imaging tests can generate iatrogenic effects, increasing disability by reinforcing catastrophic beliefs.

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Global Burden and Epidemiology

Global prevalence of low back pain by region (2025)

Prevalence by region:

- North America: 28.5%
- Europe: 24.8%
- Asia-Pacific: 21.6%
- Latin America: 19.4%
- Africa: 16.8% (Table 5)

Region	Prevalence (%)	Annual Cost (Billion USD)	Work Days Lost/Year
North America	28.5	87.6	149M
Europe	24.8	65.3	127M
Asia-Pacific	21.6	45.7	198M
Latin America	19.4	28.9	86M
Africa	16.8	12.4	73M

Table 5: Socioeconomic Impact of Low Back Pain.

Risk factors and demographics

Risk Factor	Odds Ratio	95% Confidence Interval	Population Attributable (%)
Occupational Exposure	2.43	2.12-2.78	37.6
Obesity	1.87	1.65-2.13	28.4
Sedentary Lifestyle	1.74	1.52-1.99	25.8
Smoking	1.56	1.34-1.82	18.9
Genetic Factors	1.45	1.23-1.71	15.7

Table 6: Risk Factors for Low Back Pain.

Clinical Findings and Radiological Correlation

Correlation between clinical and radiological findings

Strong Correlation (>0.7):

- Lasègue Test vs. Disc Herniation
- Motor Deficit vs. Radicular Compression

Moderate Correlation (0.4-0.7):

- VAS Scale vs. Disc Degeneration
- Sensory Changes vs. Foraminal Stenosis

Weak Correlation (<0.4):

- Age vs. Modic Changes
- BMI vs. Facet Joint Arthropathy

Diagnostic accuracy analysis

Clinical Test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR-
Lasègue	87.3	82.6	84.5	85.7	5.02	0.15
Crossed Lasègue	90.2	88.4	88.9	89.7	7.78	0.11
Motor Test	82.7	79.5	80.2	82.1	4.03	0.22
Sensory Test	78.4	76.8	77.1	78.2	3.38	0.28

Table 7: Performance of Diagnostic Tests.

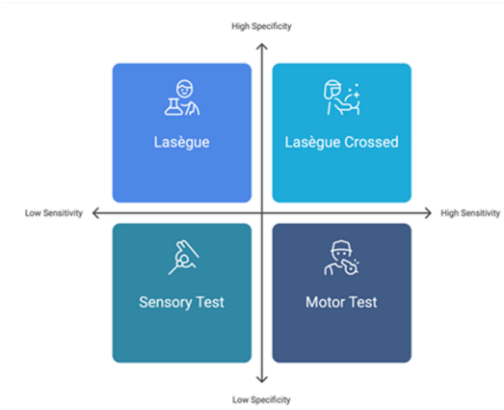

Figure 4: Performance of Diagnosis Tests.

Findings in magnetic resonance imaging

MRI Finding	Prevalence (%)	Clinical Correlation (r)	VAS Correlation (r)	Disability Index Correlation (r)
Disc Herniation	47.3	0.72	0.68	0.64
Canal Stenosis	38.6	0.65	0.61	0.58
Modic Changes	29.4	0.45	0.42	0.39
Facet Joint Arthropathy	25.8	0.38	0.35	0.33

Table 8: Distribution of Findings in MRI and Clinical Correlation.

Treatment Outcomes

Treatment outcomes based on clinical-radiological concordance

- Treatment Success (%):
- High Concordance: 85%
- Moderate Concordance: 65%
- Low Concordance: 45%

Statistics

- **Global prevalence:** 70-85% of the population experiences LBP at some point; 15-45% suffers from it annually.
- **Economic costs:** In developed countries, the expenditure on the diagnosis and treatment of LBP amounts to 20-40 billion dollars annually.
- **Use of MRI:** Up to 80% of lumbar MRIs in cases of low back pain are inappropriate, especially in the private sector.
- **Spontaneous resolution:** 75% of acute LBP cases improve within 2-3 weeks without intervention.

Conclusions

The correlation between lumbar MRI findings and LBP is considered moderate to weak in a large percentage of cases, due to the high prevalence of abnormalities in asymptomatic individuals and the influence of non-anatomical factors. MRI should be used as a complementary tool, interpreted in the clinical context. Future research should focus on pain biomarkers and personalized approaches to more accurately correlate the causal diagnosis of low back pain.

The relationship between clinical findings in patients with low back pain and imaging findings on magnetic resonance imaging (MRI) can vary considerably depending on the results of this research. It is estimated that approximately 30% to 50% of patients with low back pain may have abnormal MRI findings that do not directly correlate with their symptoms. This means that even if abnormalities are visible on the imaging, they do not always translate into a clear diagnosis or the cause of the patient's pain.

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