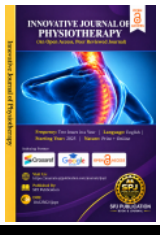
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Original Research

Correlation Between MRI-Based Lumbar Disc Degeneration and Functional Disability Among Patients Undergoing Physiotherapy

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ABSTRACT

Background: Lumbar disc degeneration is a common cause of low back pain and functional impairment. Magnetic resonance imaging (MRI) provides valuable structural information, while standardised clinical assessments help evaluate associated disability.
Objective: To investigate the correlation between MRI-based lumbar disc degeneration and functional disability among patients undergoing physiotherapy.
Methods: An observational analytical study involving 124 patients with low back pain was considered. Lumbar disc degeneration was assessed using the Pfirrmann grading system. Pain intensity and functional disability were evaluated using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI), respectively. Spearman's correlation analysis was used to examine associations between imaging and clinical parameters. Changes in clinical outcomes following physiotherapy were assessed using paired statistical analysis.
Results: Grade IV disc degeneration was the most frequently observed finding (41.9%), followed by Grade III (30.6%). MRI degeneration grade demonstrated positive correlations with VAS ($\rho = 0.624$, $p < 0.001$) and ODI scores ($\rho = 0.555$, $p < 0.001$). Following physiotherapy, mean VAS scores decreased from 3.67 ± 1.30 to 2.27 ± 1.37, while ODI scores decreased from $25.02 \pm 11.53\%$ to $17.11 \pm 11.17\%$ ($p < 0.001$).
Conclusion: MRI-based lumbar disc degeneration demonstrated positive associations with pain intensity and functional disability. Integrating radiological findings with clinical assessment may support comprehensive evaluation and rehabilitation planning.

Keywords: Lumbar Disc Degeneration, Magnetic Resonance Imaging, Pfirrmann Grading, Physiotherapy, Oswestry Disability Index

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INTRODUCTION

Lumbar disc degeneration is a common structural abnormality of the intervertebral discs and is frequently identified among individuals presenting with low back pain. It is characterised by progressive changes in disc composition, hydration, height, and structural integrity, which may contribute to altered spinal biomechanics and functional limitations. [1,2] Although degenerative changes are commonly observed with increasing age, their relationship with clinical symptoms varies considerably between individuals. [3] Therefore, identifying the association between radiological abnormalities and clinical manifestations is important for appropriate assessment and rehabilitation planning. Magnetic resonance imaging (MRI) is an important diagnostic modality for evaluating lumbar intervertebral disc degeneration because of its excellent soft-tissue contrast and ability to demonstrate disc desiccation , reduced disc height, bulging, protrusion, and associated neural structures. [4,5] The Pfirrmann grading system provides a standardised method for classifying lumbar disc degeneration according to MRI signal intensity, internal structure, distinction between the nucleus pulposus and annulus fibrosus, and disc height. [6] However, MRI abnormalities do not always corresponds directly with pain severity or functional disability, as degenerative findings may also occur in asymptomatic individuals. [3,7] Physiotherapy plays an important role in the conservative management of patients with lumbar degenerative disorders. Therapeutic interventions, including structured

exercise programmes, core stabilisation, flexibility training, postural correction, and patient education, aim to reduce pain, improve spinal mobility, and restore functional independence. [8,9] The Oswestry Disability Index (ODI) is a widely used validated questionnaire for assessing disability associated with low back pain and evaluating limitations in activities of daily living. [10] Pain intensity can additionally be assessed using a numerical rating scale to monitor clinical improvement.

Understanding the relationship between MRI-based lumbar disc degeneration and functional disability may help establish the clinical relevance of imaging findings and support individualised rehabilitation strategies. Therefore, this study aims to investigate the correlation between MRI-based lumbar disc degeneration and functional disability among patients undergoing physiotherapy, considering pain intensity, ODI scores, and functional improvement. [11-14]

MATERIALS AND METHODS

Study Design and Participants: A hospital-based observational analytical study was conducted involving 124 patients presenting with low back pain and undergoing physiotherapy. Participants were recruited based on predefined inclusion and exclusion criteria. Patients with previous lumbar spine surgery, spinal trauma, infection, malignancy, or incomplete clinical records were excluded.

MRI Assessment: Lumbar spine MRI was evaluated using sagittal T1-weighted, T2-weighted, and axial T2-weighted sequences. Intervertebral disc degeneration from L1–L2 to L5–S1 was graded using the five-point Pfirrmann classification system (Grades I–V). The highest degeneration grade was recorded for each participant.

Clinical and Functional Assessment: Pain intensity was assessed using the Visual Analogue Scale (VAS; 0–10), while functional disability was evaluated using the Oswestry Disability Index (ODI), expressed as a percentage. Higher scores indicated greater pain intensity and functional disability, respectively.

Physiotherapy Assessment: Participants received individualised physiotherapy interventions, including lumbar stabilisation, core strengthening, flexibility exercises, and postural training. Clinical outcomes were assessed at baseline and after four weeks to determine changes in pain intensity and functional disability.

Statistical Analysis: Data from 124 participants were analysed using appropriate statistical software. Descriptive statistics were expressed as mean ± standard deviation or frequency and percentage.

RESULT

A total of 124 participants with low back pain undergoing physiotherapy were included in the study. The demographic and clinical characteristics of the study population are presented in **Table 1**. The mean age of participants was 45.43 ± 9.46 years, with males accounting for 53.2% (n = 66) and females 46.8% (n = 58). The mean baseline VAS and ODI scores were 3.67 ± 1.30 and 25.02 ± 11.53, respectively.

Table 1. Demographic and clinical characteristics of study participants (n = 124)

Parameters	Frequency / Mean ± SD
Age (years)	45.43 ± 9.46
Male, n (%)	66 (53.2)
Female, n (%)	58 (46.8)
Baseline VAS score	3.67 ± 1.30
Baseline ODI score (%)	25.02 ± 11.53

Table 2 presents the distribution of lumbar intervertebral disc degeneration according to the Pfirrmann grading system. Grade IV degeneration was the most prevalent finding, observed in 52 participants (41.9%), followed by Grade III in 38 (30.6%) and Grade V in 22 (17.7%). Grade II degeneration was identified in 12 participants (9.7%), whereas no participants were classified as Grade I.

Table 2. Distribution of lumbar disc degeneration according to Pfirrmann grading

Pfirrmann grade	Degeneration severity	Frequency (n)	Percentage (%)
Grade I	Normal	0	0.0
Grade II	Mild	12	9.7
Grade III	Moderate	38	30.6
Grade IV	Advanced	52	41.9
Grade V	Severe	22	17.7
Total		**124**	**100.0**

The correlation analysis demonstrated a significant positive association between MRI-based lumbar disc degeneration and clinical outcomes (**Table 3**).

Table 3. Correlation between MRI-based lumbar disc degeneration and clinical outcomes (n = 124)

Variables	Spearman's ρ	95% CI	p-value
MRI degeneration grade vs. VAS	0.624	0.503 – 0.721	<0.001
MRI degeneration grade vs. ODI	0.555	0.420 – 0.668	<0.001
VAS vs. ODI	0.656	0.543 – 0.747	<0.001

Note: ρ = Spearman's rank correlation coefficient; CI = confidence interval; VAS = Visual Analogue Scale; ODI = Oswestry Disability Index.

Pfirrmann degeneration grade showed a positive correlation with VAS scores ($\rho = 0.624$, $p < 0.001$) and ODI scores ($\rho = 0.555$, $p < 0.001$). Additionally, a significant positive correlation was observed between VAS and ODI scores ($\rho = 0.656$, $p < 0.001$), indicating that greater pain intensity was associated with higher functional disability. Changes in clinical outcomes following physiotherapy are presented in **Table 4**. The mean VAS score decreased from 3.67 ± 1.30 at baseline to 2.27 ± 1.37 following physiotherapy, representing a mean reduction of 1.40 points (95% CI: 1.30–1.50; $p < 0.001$). Similarly, the mean ODI score decreased from 25.02 ± 11.53% to 17.11 ± 11.17%, with a mean reduction of 7.90 percentage points (95% CI: 7.22–8.58; $p < 0.001$).

Table 4. Comparison of clinical outcomes before and after physiotherapy (n = 124)

Parameters	Baseline (Mean ± SD)	Post-physiotherapy (Mean ± SD)	Mean Difference	95% CI	p-value
VAS score	3.67 ± 1.30	2.27 ± 1.37	1.40	1.30 – 1.50	<0.001
ODI score (%)	25.02 ± 11.53	17.11 ± 11.17	7.90	7.22 – 8.58	<0.001

Note: VAS = Visual Analogue Scale; ODI = Oswestry Disability Index. Paired-sample t-test.

DISCUSSION

The present study investigated the relationship between MRI-based lumbar disc degeneration and functional disability among 124 patients undergoing physiotherapy. The findings demonstrated positive associations between Pfirrmann degeneration grades, pain intensity, and functional disability. The correlation between MRI degeneration grade and VAS ($\rho = 0.624$) indicated that greater structural degeneration was associated with increased pain intensity. Similarly, the association with ODI ($\rho = 0.555$) suggested that progressive disc degeneration was accompanied by greater limitations in daily functional activities. These findings highlight the potential clinical relevance of MRI assessment when interpreted alongside patient-reported outcomes. The observed relationship between VAS and ODI scores ($\rho = 0.656$) further indicates that pain intensity is closely associated with functional impairment. Nevertheless, structural abnormalities on MRI should not be considered independent indicators of clinical severity, as degenerative changes may also occur in asymptomatic individuals. Therefore, integrating radiological findings with clinical assessment is essential for comprehensive patient evaluation.

Following physiotherapy, reductions in mean VAS and ODI scores suggested improvements in pain and functional disability. The decrease in VAS from 3.67 to 2.27 and ODI from 25.02% to 17.11% indicates favourable clinical changes during the rehabilitation period. These improvements may be associated with the effects of lumbar stabilisation exercises, core strengthening, flexibility training, and postural correction. The findings support the complementary role of MRI and standardised functional assessment in evaluating patients with lumbar disc degeneration. However, the relationship between structural degeneration and rehabilitation response requires further investigation through prospective studies with larger samples, standardised physiotherapy protocols, and longer follow-up periods

CONCLUSION

MRI-based lumbar disc degeneration demonstrated a positive association with pain intensity and functional disability. Physiotherapy was associated with improvements in pain and functional outcomes, highlighting the importance of combining radiological assessment with clinical evaluation for effective rehabilitation planning.

DECLARATIONS

Ethical Approval: The study was conducted after obtaining NOC from the School of Allied & Healthcare Sciences, YBN University, Ranchi, India.
Informed Consent: Written informed consent was obtained from all participants before enrolment in the study.
Funding: This research received no external funding.
Conflict of Interest: The authors declare no conflicts of interest related to this study.
Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to institutional policies and participant confidentiality requirements.

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