Journal of Positive Psychology & Wellbeing
2024, Vol. 8, No. 2, 196-202

http://journalppw.com
ISSN 2587-0130

A Correlation between MRI findings in current and future Disc Herniation Grade 1- Amongst Low Back Pain Patients

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Abstract

Background: Magnetic resonance imaging (MRI) is a procedure used to assess the effects of a herniated disc. There is a hypothesis that there might be a correlation between MRI findings at baseline and follow-up to determine whether there is an ability to predict future progress in LBP among LBP patients with non- or mild disc prolapse (grade 1-disc herniation) with the help of MRI findings.

Method: This study consisted of a total of 70 patients, all of whom gave their informed consent to participate in the study. Using the Visual Analogue Scale (VAS), patients were asked to rate how intense the back pain was and to complete the Roland Morris Disability Questionnaire for an assessment of their disability. For all patients, the spine was assessed by MRI scan. Within 1.5 years of baseline MRI scan, 39 volunteers were repeat MRI scan for LBP patients.

Result: In this study, we found that age, VAS, disability index, and disc herniation were weakly correlated. Pain and disability also had a weak relation with Grade 1 (r=0.11, r=0.04). In addition, Our longitudinal study found that most of the MRI findings did not seem to be linked to future LBP - severity, whether the participant experienced LBP in the past or not (r= 0.07, p=0.8).

Conclusion: it was discovered that MRI scans in both ongoing and forthcoming studies do not exhibit a statistically noteworthy association with the magnitude and position of lumbar disc herniation, pain, and disability.

Keywords*:* Low back pain, Disability, Disc Prolapse, MRI, MSU.

Introduction

Chronic Low Back Pain (LBP) changes nearly 80% of the population lifetime, affects intervertebral disc structural and continue to be leading cause the disabilities.1 The use of magnetic resonance imaging (MRI) is one of the most reliable imaging techniques used to diagnose and assess the state of the intervertebral discs in order to assess the level of degeneration and pathological processes, especially disc herniation and inflammation of the endplates.2-4 Furthermore, MRI is one of the best imaging techniques for examining the relationship between the intervertebral disc and the soft tissues and nerves that surround it.5 As a result, the spinal canal and spinal cord are also useful for assessing pathologies.6,7 MRIs are extremely useful in measuring the shape, size, extent and location of disc herniations that have occurred in the body 8 In some cases, however, MRI findings do not identify the source of low back pain 1-8.

Sciatica patients who suffer from persistent or recurrent symptoms of sciatica are usually examined with MRI to determine whether there has been a lumbar disc prolapse 9-10. Patients with severe symptoms for at least six to eight weeks should undergo magnetic resonance imaging (MRI) if conservative treatment has failed to resolve their symptoms1-8. It may be necessary to perform surgical interventions in these patients, and MRIs provide us with a means of evaluating the impact of the slipped disc on the nerve roots. The association between MRI findings and patient symptoms is still controversial, as previous studies have demonstrated disc herniation in patients without obvious symptoms 11. As a result of these abnormal MRI results, invasive treatments like epidural injections or surgical procedures may be required 12.

Based on MRI findings at baseline, little research has been conducted regarding the impact of pain intensity and long-term LPB using follow-up MRI techniques 2-4. MRI findings at baseline and follow up will be correlated in this study to predict the progress of LBP in patients with mild or non-prolapsed discs (grade 1-disc herniation).

Material and methods

The research was carried out at King Khalid Hospital's Department of Radiology in Hail, Saudi Arabia. The study comprised a total of 70 individuals who were experiencing sciatica. These patients were categorized as grade-1, depending on the size and position of the herniated disc within the spinal canal. Only patients exhibiting a dermatomal pattern of pain distribution were included in the MRI study. Within a span of 1.5 years from the initial MRI scan, 39 participants were subjected to a follow-up MRI scan specifically for low back pain (LBP) patients.

The study included male and female participants aged between 20 and 60 years old, who volunteered to participate and did not exhibit any cognitive impairments. Individuals with specific causes of lower back pain, such as tumors, injuries, spinal deformities (scoliosis, kyphosis, spondylolisthesis), trauma, vascular disease, rheumatoid arthritis, fracture, infection, pregnancy, congenital abnormalities, ankylosing spondylitis, hernias, visceral problems, fibromyalgia, myofascial pain, and those taking corticosteroids, were not eligible for the research. Additionally, individuals diagnosed with cauda equina syndrome and those requiring emergency surgery were also not included in the study.

Information gathered on the participants encompassed age, gender, residence, lifestyle, educational background, smoking and dietary patterns. A thorough evaluation was carried out on the duration, site, radiation, triggers, and alleviating factors of sciatic pain. Additionally, medical and neurological assessments were conducted. The research was undertaken at the Radiology department of King Khalid Hospital in Hail, Saudi Arabia. The study comprised a total of 70 individuals afflicted with sciatica. Patients were categorized into grade-1 based on the size and position of the herniated disc within the spinal canal. Only patients exhibiting a dermatomal pain distribution pattern were included in the MRI study. Within 1.5 years of the initial MRI scan, 39 volunteers underwent follow-up MRI scans for lower back pain patients.

Eligible participants for the research study were individuals aged between 20 and 60, of any gender, who agreed to participate and did not have any cognitive impairments. Exclusions from the study comprised individuals with specific conditions leading to low back pain, such as tumors, injuries, spinal deformities, trauma, vascular disease, rheumatoid arthritis, fractures, infections, pregnancy, congenital abnormalities, ankylosing spondylitis, hernias, visceral problems, fibromyalgia, myofascial pain, and those using corticosteroids. Additionally, individuals diagnosed with cauda equina syndrome requiring emergency surgery were not included in the study.

The age, gender, address, lifestyle, education level, smoking, and dietary habits of the participants were all gathered and documented. A comprehensive assessment was performed to acquire data regarding the duration, location, radiation, aggravating, and relieving factors of sciatic pain. Furthermore, both a medical examination and a neurological examination were conducted.

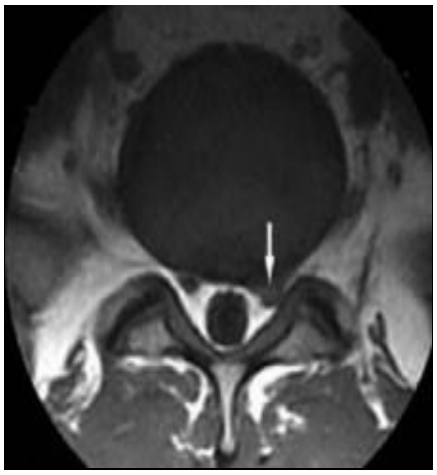
Procedure

Pain Severity Assessment: The intensity of pain was measured using a visual analog scale, where participants indicated their current level of pain on a scale that ranged from "no pain" to "unbearable pain."

Functional Impairment Evaluation: To assess functional disability, the Rolland Morris Disability Questionnaire (RMDQ) was utilized. This questionnaire specifically focused on the impact of low back pain on daily activities. A validated Arabic version of the RMDQ was used to gain insights into the study population. Patients selected statements that best described their current back pain symptoms during functional activities, and the total score ranged from 0 (indicating no disability) to 24 (indicating severe disability).

Spinal MRI Procedure: All patients underwent spinal MRI imaging while lying in a supine position. A 1.5 T MRI machine equipped with a 24-element body spine surface coil was used for the procedure. T1-weighted axial images and T2-weighted sagittal images were captured both before and after the administration of gadolinium diethyl enetriaminepenta-acetic acid (Gd-DTPA). The MRI findings from L1 to S1 were evaluated and interpreted by two experienced musculoskeletal radiologists. The classification system used to assess lumbar disc herniation on the MRI was the Michigan State University (MSU) Classification, which takes into account the size and location of the herniation based on a single measurement of the intra-facet line. Additionally, guidelines from the North American Spine Society, the American Society of Spine Radiology, and the American Society of Neuroradiology were followed for the classification of lumbar disc pathology.

Correlation Analysis: A Pearson correlation coefficient was computed using SPSS 26.0 to investigate the potential association between the location or size of the herniated disc and the levels of pain and disability.



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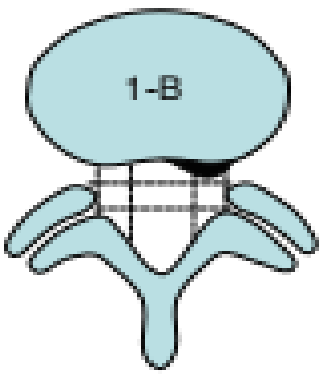

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Figure 1: (a) Grade 1 disc herniation with minimal impact on nerve compression, (b) MRI axial T2 weighted image and (c) sagittal T1 shows L4-L5 lumbar disc herniation.

Result:

1. This study aimed to explore the relationship between initial and subsequent MRI findings in predicting the progression of lower back pain (LBP) in patients with non or mild disc prolapse (grade 1 disc herniation). The research involved 70 patients with an average age of 36 ± 8.3 years. The participants had an average height of 174.3 centimeters and an average weight of 75.3 kilograms. The baseline assessment showed a mean VAS score of 7.8 ± 1.5 and a mean Rolland Morris Disability score of 14.8 ± 3.6. In the follow-up evaluation, the mean VAS score was 7.4 ± 1.2, and the mean Rolland Morris Disability score was 14.6 ± 3.1. The correlation coefficient (r) between the initial and subsequent VAS scores was 0.07, with a p-value of less than 0.8.

The mean VAS score indicated the pain intensity in patients with disc herniation at the L4-L5 and L5-S1 levels as 6.8 ± 1.4 and 7.8 ± 1.4, respectively. Patient distribution based on characteristics such as age, gender, body mass index, symptom duration, pain radiation, and disc herniation is presented in Table 1. Patients were divided into three groups based on the size and location of the herniated disc [Table 2].

No significant correlation was found between the lumbar disc herniation level and patient sex (r = 0.12; P = 0.18). Pain intensity (VAS) did not exhibit a relationship with patient age (r = 0.08; P = 0.79) or the duration of their lower back pain (r = 0.012; P = 0.90). Additionally, the disability index (RMDQ) did not show a correlation with patient age (r = 0.11; P = 0.02) or the duration of their lower back pain (r = 0.05; P = 0.23). However, pain intensity (VAS) was correlated with disability (r = 0.38; P = 0.005). There was no association between the degree of disc herniation and either pain (r = 0.13; P = 0.01) or disability (r = 0.05; P = 0.001).

This cross-sectional study employed Pearson's correlation coefficient to determine the relationship between disc herniation and its clinical manifestations, specifically pain and disability, in patients with LBP. A weak correlation was noted during the initial assessment between grade 1 disc herniation and both pain intensity (r = 0.11; P = 0.01) and functional disability (r = 0.04; P = 0.001). Similarly, during the follow-up examination, a weak correlation was observed between grade 1 disc herniation and pain intensity (r = 0.27; P = 0.01) as well as functional disability (r = 0.14; P = 0.01) [Table 3].

Table 1: Distribution of the subjects with their characteristics.

Characteristics	Variables	N = 70 n [(n/N) %]
Age	20 – 29 years	18 [23]
	30 – 39 years	23 [32%]
	40 – 49 years	11 [15]
	50 – 59 years	8 [11]
Gender	Male	38 [54%]
	Female	32 [46%]
Radiation of Pain into legs	Yes	70 [100%]
	No	0 [0]
Body Mass Index [BMI]	Normal	51[70%]
	Overweight	19 [27%]
	Obese	0 [0.0%]
Disc Herniation	L4 – L5	43 [61%]
	L5 – S1	27 [39%]

* MSU – Michigan State University Classification.

Table 2: Distribution of the patients based on their size and level of disc herniation

Characteristics	Variables	N = 70
MSU [Grade – 1]	A	36
	B	18
	AB	16
	Total	70

Table 3: Correlation between pain, disability and level of disc prolapse.

Parameters	'r' Value with p value	Interpretation
MSU – Grade 1		
Baseline Exam		
Pain & MSU	r = 0.11; P = 0.01	Weak Correlation
Disability & MSU	r = 0.04; P = 0.01	Weak Correlation
Follow up exam		
Pain & MSU	r = 0.27; P = 0.01	Weak Correlation
Disability & MSU	r = 0.14; P = 0.01	Weak Correlation

Discussion:

In this investigation, it was discovered that MRI scans in both ongoing and forthcoming studies do not exhibit a statistically noteworthy association with the magnitude and position of lumbar disc herniation, pain, and disability. The examinations exploring the relationship between MRI degenerative discoveries and low back pain differ significantly in terms of their structure, sample origin, duration of follow-up, and pain assessment, thereby posing difficulties in directly comparing them with prior studies. Additional MRI findings were detected in both older adults experiencing symptoms and those without symptoms, aligning with previous research.10-12 In our study, all participants reported experiencing pain radiating into their legs, whereas Boden et al. found that disc herniation, spinal canal stenosis, disc degeneration, and bulging discs were present in a significant proportion of asymptomatic individuals aged 20 to 80 years.12

Boden et al. conducted an MRI study and found that 33% of asymptomatic individuals aged 20 to 80 years had disc herniation, spinal canal stenosis, disc degeneration, and bulging discs. In studies focusing on young and athletic individuals with symptomatic disc degeneration, higher rates of disc degeneration, Modic change, and disc herniation were observed. However, no correlations were identified. The discrepancy in findings could be attributed to various factors, including research design, sample characteristics, and the definition of low back pain. Previous longitudinal studies with limited sample sizes and individuals experiencing current pain were unable to establish a significant link between specific MRI findings and low back pain during follow-up.13-18

One study of adults without current LBP found that spondylolisthesis and disc degeneration were linked to an increased risk of future LBP episodes.19 According to Borenstein et al., disc herniation, spinal canal stenosis, disc bulge, and disc degeneration have been shown to be associated with the onset of low back pain in individuals who did not previously experience pain.14 Our findings are consistent with previous research that suggests no correlation between MRI results and lower back pain (LBP). Limited studies have been conducted on the connection between MRI findings and future pain, with only a handful exploring the relationship between the number of MRI findings and future LBP. In a study by Hancock et al., it was discovered that patients with three or more MRI findings had a higher likelihood of experiencing recurring LBP compared to those without any initial pain. Conversely, McNee et al. found no association between the number of MRI findings and lumbar pain after 18 months among individuals with a history of lumbar spine issues.15 Based on our research findings, it was observed that participants who underwent MRI scans had higher average pain severity scores. Conversely, there was little to no correlation found among individuals with lower back pain (LBP) at the initial stage.

Conclusion:

MRI scans in both ongoing and forthcoming studies do not exhibit a statistically noteworthy association with the magnitude and position of

lumbar disc herniation, pain, and disability. The MRI degenerative discoveries and low back pain differ significantly in terms of their structure, sample origin, duration of follow-up, and pain assessment, therefore posing difficulties in directly comparing them with previous studies.

Acknowledgement: We take this opportunity to thank all the participants of this study, and the MRI technician and nurse who assisted in taking the MRIs.

Conflict of Interest: There is no funding agency / research support / potential conflict of interest relevant to this article was reported.

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