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An MRI longitudinal study in Low back Pain Patients: Assessment of Disc Herniation Grade 2

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Abstract

Background: A herniated disc is assessed by Magnetic Resonance Imaging (MRI). We assessed 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 moderate disc prolapse (grade 2-disc herniation).

Method: This is was a prospective longitudinal study conducted at single center with total of 65 patients , all of whom gave their informed consent to participate. Utilizing the Visual Analogue Scale (VAS), patients were approached to rate how extreme the back pain was and to complete the Roland Morris Disability Questionnaire for an evaluation of their disability. Then, the spine was assessed by MRI scan for all participants. Within 1.5 years of baseline MRI scan, 49 volunteers were repeat MRI scan for LBP patients.

Result: The study found weak correlations between age, VAS scores, disability index, and the presence of disc herniation and LBP patients with moderate prolapsed discs (grade 2-disc herniation). Pain and disability also had a weak relation with Grade 2 (r=0.13, r=0.05). In addition, most MRI findings did not demonstrate a significant association with future LBP severity, regardless of whether participants had a history of LBP or not (correlation coefficient, r=0.08, p=0.7)

Conclusion: It was concluded that MRI findings 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 for LBP patient with grade 2 disc herniation.

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

Introduction

O Chronic Low Back Pain (LBP) affects about 80% of people's lives. It is also leading cause the disabilities and disc degeneration 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 to assess the level of degeneration and pathological processes, particularly disc herniation and inflammation of the endplates 2-4. In addition, MRI is used widely imaging techniques for assessing the relationship between the intervertebral disc and surrounding soft tissues and nerves 5. Therefore, the spinal canal and spinal cord can also be used to assess pathologies 6,7. MRIs are particularly useful for measuring disc herniations in the body's shape, size, extent , and location 8. However, MRI results may not detect the source of LBP 1-8.

In order to ascertain whether a lumbar disc prolapse has occurred, sciatica patients who experience persistent or recurrent symptoms would typically undergo an MRI 9–10. When conservative treatment fails to relieve symptoms, patients who have experienced severe symptoms for at least six to eight weeks should have MRI 1–8. In these patients, surgical interventions might be required, and MRIs provide useful information in terms of assess how the slipped disc affects the nerve roots. Previous research has shown that patients with disc herniation even had no apparently noticeable symptoms, so the relationship between MRI results and LBP patient symptoms is still debatable 11. Invasive therapies such as epidural injections or surgical procedures may be necessary because of these abnormal MRI results 12.

Based on baseline MRI findings, research on the relationship between pain intensity and long-term LPB using follow-up MRI techniques has been limited,. 2-4. Therefore, the aim of the current study is to examine how the initial MRI findings and subsequent follow-up results can be used to predict the advancement of LBP in patients with moderate prolapsed discs (grade 2-disc herniation).

Material and methods

This was a prospective longitudinal study conducted at the Radiology Department King Khalid Hospital, Hail, Saudi Arabia in a period 2020 to 2022. There were 65 people with sciatica in the study as a whole. Depending on how big and where the herniated disc was inside the spinal canal, these patients were classified as grade 2. The MRI research only included patients who displayed a dermatomal pattern of pain distribution. Forty-nine individuals underwent a follow-up MRI scan designed for patients with LBP within a period of 1.5 years after the initial MRI scan.

The inclusion criteria of the study include all participants with sciatica without any cognitive impairments, both genders with ages between 20 and 60 years were included in the study. The study excluded participants with the following specific causes of lower back pain: tumors, injuries, rheumatoid arthritis, fibromyalgia, myofascial pain, pregnancy, congenital abnormalities, ankylosing spondylitis, hernias, visceral issues, fibromyalgia, myofascial pain, those in pregnancy and ages less than 20 or higher than 60 years. Furthermore, excluded from the study were those who needed emergency surgery and those who had been diagnosed with cauda equina syndrome.

Participant data included age, gender, place of residence, way of life, educational background, history of smoking, and eating habits. The duration, location, radiation, triggers, and factors that alleviate sciatic pain were all thoroughly examined.

Procedure

Pain Severity Assessment: Using a visual analog scale (VAS), which ranged from "no pain" to "unbearable pain," participants indicated how much pain they were experiencing at the moment. ".

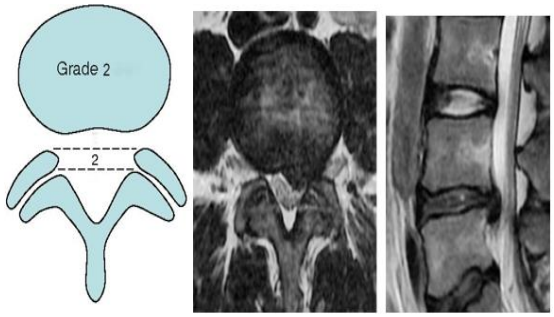
Functional Impairment Evaluation: The Rolland Morris Disability Questionnaire (RMDQ) was used to evaluate functional disability. This survey was specially designed to measure how low back pain affected day-to-day activities. To learn more about the study

population, an Arabic version of the RMDQ that has been validated was employed. During functional activities, patients chose statements that most accurately reflected their current back pain symptoms. The total score ranged from 0 (indicating no disability) to 24 (indicating severe disability).

Spinal MRI Procedure:

All participants were scanned in a supine position using a 1.5 T MRI machine that had a 24-element body spine surface coil attached to it. The gadolinium diethyl enetriamine penta-acetic acid (Gd-DTPA) was administered both prior to and following the acquisition of T1-weighted axial images and T2-weighted sagittal images. Two skilled musculoskeletal radiologists with experience 10 years assessed and interpreted the results of the MRI scans from L1 to S1. The Michigan State University (MSU) Classification was utilized to evaluate lumbar disc herniation on MRI scans. This classification system considers the size and location of the herniation based on a single intra-facet line measurement. For the classification of lumbar disc pathology, recommendations from the American Society of Neuroradiology, the American Society of Spine Radiology, and the North American Spine Society were also followed (Figure 1).

Correlation Analysis: Using SPSS 26.0, a Pearson correlation coefficient was calculated to investigate any possible relationships between the location or extent of the herniated disc and the degrees of pain and disability.



(a) (b) (c)

Figure 1: (a) Grade 2 disc herniation with medium impact on nerve compression, (b) MRI axial T2 weighted image and (c) sagittal T1 shows L4-L5 lumbar disc herniation.

Result:

The research involved 65 patients with an average age of 33 ± 11.4 years. The participants had an average height of 176.7 centimeters and an average weight of 81.2 kilograms. The baseline assessment showed a mean VAS score of 6.9 ± 1.4 and a mean RMDQ of 15.3 ± 4.6. In the follow-up evaluation, the mean VAS score was 7.2 ± 1.6, and the mean RMDQ score was 14.4 ± 2.8. The correlation coefficient (r) between the initial and subsequent VAS scores was 0.08, with a p-value of less than 0.7.

The mean VAS score indicated the pain intensity in patients with disc herniation at the L4-L5 and L5-S1 levels as 7.1 ± 1.2 and 7.3 ± 1.3, 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 ($r = 0.17$; $P = 0.12$). Pain intensity (VAS) did not exhibit a relationship with patient age ($r = 0.09$; $P = 0.67$) or the duration of their LBP ($r = 0.01$; $P = 0.80$). Additionally, the disability index (RMDQ) did not show a correlation with patient age ($r = 0.2$; $P = 0.03$) or the duration of their lower back pain ($r = 0.06$; $P = 0.34$). However, pain intensity (VAS) was correlated with disability ($r = 0.42$; $P = 0.005$). There was no association between the degree of disc herniation and either pain ($r = 0.17$; $P = 0.01$) or disability ($r = 0.07$; $P = 0.001$).

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 ($r = 0.13$; $P = 0.02$) and functional disability ($r = 0.05$; $P = 0.02$). Similarly, during the follow-up examination, a weak correlation was observed between grade 2

disc herniation and pain intensity (r = 0.22; P = 0.01) as well as functional disability (r = 0.18; P = 0.02) [Table 3].

Table 1: Distribution of the subjects with their characteristics.

Characteristics	Variables	N = 65 n [(n/N) %]
Age	20 – 29 years	16 [24%]
	30 – 39 years	28 [43%]
	40 – 49 years	13 [20%]
	50 – 59 years	8 [12%]
Gender	Male	36 [55%]
	Female	29 [45%]
Radiation of Pain into legs	Yes	65 [100%]
	No	0 [0]
Body Mass Index [BMI]	Normal	52[80%]
	Overweight	13 [20%]
	Obese	0 [0.0%]
Disc Herniation	L4 – L5	45 [69%]
	L5 – S1	20 [31%]

* MSU – Michigan State University Classification.

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

Characteristics	Variables	N = 65
MSU [Grade – 1]	A	34
	B	16
	AB	15
	Total	65

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

Parameters	'r' Value with p value	Interpretation
MSU – Grade 2		
Baseline Exam		
Pain & MSU	r = 0.13; P = 0.02	Weak Correlation
Disability & MSU	r = 0.05; P = 0.02	Weak Correlation
Follow up exam		
Pain & MSU	r = 0.22; P = 0.01	Weak Correlation
Disability & MSU	r = 0.18; P = 0.02	Weak Correlation

Discussion:

In this study, 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 in LBP patients with disc herniation grade 2.One of the most reliable imaging methods for diagnosing and evaluating the condition of the intervertebral discs is MRI. This technique allows for the assessment of pathological processes and levels of degeneration, including disc herniation and endplate inflammation2-4. Furthermore, MRI is a commonly used imaging technique for evaluating the intervertebral disc's relationship to the surrounding nerves and soft tissues 5.

There are significant differences in the design, sample origin, length of follow-up, and pain assessment between the examinations investigating the relationship between MRI degenerative discoveries and low back pain, making direct comparisons with previous studies challenging. Further MRI findings were found in older adults who had symptoms as well as those who did not, which is consistent with other studies 10-12. In contrast to Boden et al., all of the participants in our study reported feeling pain that was radiating into their legs. It showed that a considerable percentage of asymptomatic people between the ages of 20 and 80 had spinal canal stenosis, bulging discs, disc degeneration, and disc herniation 12.

There were higher rates of disc degeneration, disc herniation, and modulic change in studies involving young, physically fit people who had symptomatic disc degeneration. No correlations, nevertheless, were found 13-18. Several variables, such as the definition of low back pain, sample characteristics, and research design, could be to blame for the inconsistent results 13-18. There was no significant correlation found during follow-up between specific MRI findings and low back pain, despite previous longitudinal studies having small sample sizes and involving individuals with current pain13-18.

In line with Borenstein et al. It has been demonstrated that in people who had never felt pain before, disc degeneration, disc bulge, spinal canal stenosis, and disc herniation are linked to the development of low back pain 14. Our results support earlier studies that found no connection between MRI findings and (LBP. Few studies have looked at the relationship between the number of MRI findings and future LBP 14. A limited number of studies have also looked at the relationship between MRI

findings and future pain 14. Hancock and colleagues conducted a study. with aimed to compare to those who did not experience any initial pain, patients with three or more MRI findings had a higher chance of developing recurrent LBP 14. On the other hand, McNee and colleagues. discovered no correlation, after 18 months, between the number of MRI findings and lumbar pain in patients with a history of lumbar spine difficulties 15. The average pain severity scores of the participants who had MRI scans were found to be higher based on our research findings. On the other hand, among those who initially experienced LBP, there was little to no correlation.

Conclusion:

In LBP patients with disc herniation grade 2, 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. There are challenges in directly comparing the MRI degenerative discoveries and low back pain with prior research because of the significant differences in their structure, sample origin, duration of follow-up, and pain assessment.

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