Original Article

Magnetic Resonance Imaging of Chronic Low Back Pain: Correlation between Pain, Disability, and Disc Herniation

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Abstract

Chronic Low Back Pain (cLBP) manifests as compressed, radiating pain from the back to the nerve root's dermatome. The best method of screening the spine of patients with cLBP is Magnetic Resonance Imaging [MRI]. The study involved 70 patiants. A visual analog scale was employed in assessing the intensity of back and leg pain of patients using a visual analog scale [VAS]. A Roland Morris Disability Questionnaire (RMDQ-Arabic version) was used to assess the disability of patients. The patients were examined clinically, followed by an MRI of the spine and lower extremities. Using the Michigan State University [MSU] disc herniation classification, Disc displacement and the degree of nerve root compression were assessed. This study uses SPSS 23.0 version to analyze curated data in the documentation using Pearson's correlations. Based on the data, the mean and standard deviation for each descriptive variable were calculated. A low grade disc herniation and a VAS rating of 3 were not correlated based on the MRI results. The Pearson correlation coefficients for disc herniation with grade three (r = -0.212) and functional disability with grade three (r = 0.17) were weak. There was a weak correlation between the intensity of pain and functional disability of these patients (r = 0.159). Clinical symptoms and MRI results of the patients who are suffering from cLBP should be correlated to decide whether to perform a therapeutic intervention as the results showed that there was a weak correlation between pain and functional disability based on the degree of disc herniation.

Keywords: Disc herniation, Chronic low back pain, IVDP, MRI, Disability

Introduction

VAS rating of 3 and low grade disc herniation were not correlated based on MRI findings. Disc herniation had a weak Pearson correlation coefficient (r = -0.212) while functional disability had a weak Pearson correlation coefficient (r = 0.17) with grade three. In this study, the intensity of pain was not strongly correlated with functional disability. Chronic low back pain (cLBP) is a condition that affects roughly eighty percent of human bieng at some point in their lives. In approximately eighty percent of cases, this pain is caused by structural changes resulting from disc degeneration [1]. Patients with disc herniation (or intervertebral disc prolapse) (r = 0.159) suffer from a variety of mechanical factors, including disc degeneration.). As a result of weak posture or a spinal injury that occurred as a result of spinal flexion or rotation, particularly during spinal exercise and back extension [2]. Disc degeneration is the most common cause of back pain [3]. In addition to supporting the spine's stability, the neuromuscular system is crucial to its biomechanics [4-6]. Pain and disability may be exacerbated by back weakness and fatigue, as well as a reduced level of spine mobility in chronic low back pain [7, 8]. In order to maintain a healthy lumbar spine, trunk muscles must contract adequately, and balance must be upheld amongst agonist and antagonist muscles, and balance of the buildings surrounding

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How to cite this article: Alshammari QT, Alsubaie AN, Alkayyat AA, Qazaq AM, Alnukhali AA, Alrefaei MGh, et al. Magnetic Resonance Imaging of Chronic Low Back Pain: Correlation between Pain, Disability, and Disc Herniation. Arch Pharm Pract. 2023;14(1):87-91. https://doi.org/10.51847/eXBJFs9GKr

it [8, 9]. Pain can delay the contraction of back muscles, increasing the risk of further spinal injury and lumbar spine dysfunction [9, 10].

It is imperative that trunk muscles contract adequately and that balance is maintained in order to maintain a healthy lumbar spine [11-13]. Furthermore, MRI allows us to see how the intervertebral disc is connected to the peripheral soft tissues and neural anatomical buildings [14, 15]. So, it is used to assess soft tissue pathologies around the spine, as well as spinal cord and spinal canal pathologies [16, 17]. It is possible to explore the size, extent, and location of the disc herniation through magnetic resonance imaging (MRI). Prolapsed discs within the spinal canal determine an IVDP patient's outcome primarily by their size and location [18]. In some patients, a disc herniation of the same size may be symptomatic, whereas in others, it may be asymptomatic [19]. Thus, clinical correlation is extremely important before treatment intervention in cLBP patients in order to minimize misinterpretation of abnormal MRI findings [20]. Therefore this study is aimed at examinining the relationship between pain and disability with disc herniation in patients with cLBP with severe disc prolapse (grade 3-disc herniation).

Materials and Methods

The study studied 70 indivivuals with pain in the lower back referred to the Radiology Department of King Khalid Hospital, Hail for lower back MRI scans between January and December 2022 after receiving ethical approval. Based on the Michigan State University grading, only grade 3 disc herniations were considered [21]. In the study, both sexes were eligible to participate, provided they were between 20 and 60 years old without cognitive impairment. Prior spinal surgery, trauma, rheumatologic disorders, spine infections, established spine exercise training within three months of the study commencement, spinal fracture, spinal abnormalities [scoliosis, kyphosis], spondylolisthesis, pregnancy, malignancy, congenital abnormalities, ankylosing spondylitis, a hernia, a visceral problem, fibromyalgia, and myofascial pain were considered exclusion criteria. Aortic aneurysms, cerebral and carotid clips, or heart pacemakers were also excluded from the study if they had absolute contraindications to MRI. After providing the patients with an overview of the Visual Analogue Scale, Rolland Morris Disability Questionnaire, and MRI scanning, their consent was obtained voluntarily. A descriptive statistical analysis of the demographic data was performed based on age, sex, occupation, height, and weight. An information booklet containing the instruction about the study, demographic information like name, age, gender, height, weight, duration of the symptom, and the measurement tools were given to the patients and asked them to mark the pain intensity in VAS and the functional disability in RMDQ.

Pain

Visual analogical scales (VAS) are used in this study to assess pain intensity. A pain level of 0 on the left extremity corresponds to a pain level of 10 on the right extremity. It was asked that patients use this scale to indicate the level of pain they are experiencing at the moment. The higher the number, the stronger the pain.

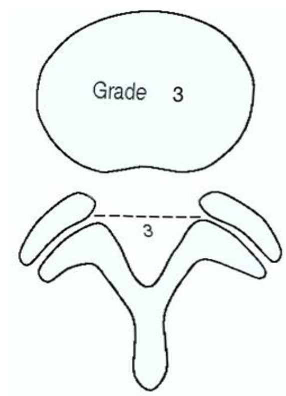
Functional Disability

RMDQ, a functional measure of LBP's impact on daily activities, was used to assess functional disability. The assessment and quantification of LBP can be done using a variety of functional questionnaires. A functional activity was used to determine which statement best described participants' symptoms. By adding up all the checked boxes, we calculated the final score. A score of 0 indicates no disability, an 11 indicates mild disability, an 18 indicates moderate disability, and 24 indicates severe disability [21].

Magnetic Resonance Imaging (MRI)

MRIs were performed on all participants supine using a 1.5 T Siemens Avanto scanner with a 24-element body spine surface coil.

T1 and T2 weighted sagittal and axial MRI sequences were performed with turbo spin echo. The procedure used as follows: T1-sagittal weighted sequences, T_1- axial multi stack and angle, T_2- sagittal weighted sequences, T_2-axial weighted sequences, T_2- STIR sagittal, T_2-axial multi stack and angle **(Figure 1)**.



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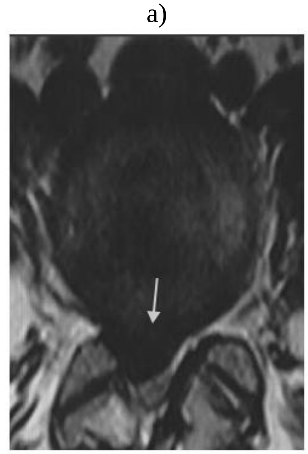

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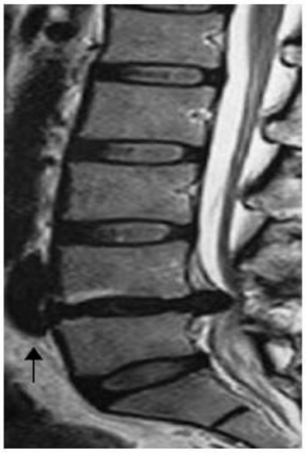

c)

Figure 1. a) An MRI showing L4-L5 lumbar disc herniation as Grade 3 and, b) an MRI showing axial T2 weighted image and, c) sagittal T2

Two musculoskeletal radiologists used standardized evaluation protocols to evaluate and interpret the MRI findings (L1 to S1). MRI is used to assess lumbar disc herniation according to the MSU Classification **(Figure 1)** [16].

Statistical Analysis

Statistical analysis was performed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Age, duration, height, weight, mean and standard deviation of VAS scores for all participants are displayed. The MRI variables pain intensity [VAS], functional impairment [RMDQ], and grade 3 disc herniation were correlated using the Pearson correlation coefficient.

Results and Discussion

Based on demographic data such as age, height, weight, and duration of the symptoms, the Mean was calculated **(Table 1)**. A total of 70 indivivufal who have grade-3 disc herniation were included, 35 were males (50%) and 35 were females (50%) The mean age of the patients was 39 ± 11.7 (range: 19-62 years old). There were 37 patients in our study who had level three disc herniations of the AB type, followed by 22 patients who had level three disc herniations of the B type. Among the 11 subjects [15.7%] with type A herniation, only 11 had it **(Table 2)**.

Table 1. Demographic data

Variables	Mean ± SD
Age (years)	39 ± 11.7
Weight (kg)	78 ± 7.6
Height (cms)	169.8 ±8.17
Duration (days)	92 ±7.73

Table 2. Distribution of the subjects

	MSU [Grade 3]
A	11 [15.7%]
B	22 [31.4%]
AB	37 [52.8%]

* MSU – Michigan State University Classification.

It was found that there was there is no considerable relationsiph existig between the level of lumbar disc herniation and the sex of the patients (p = 0.487). This group scored an average of 8 out of 10 on the VAS, while the average of 16 out of 23 on the RMDQ was determined. Pain intensity calculated with VAS score in the participants with L4-L5 level and L5-S1 level disc herniation was recorded as 7.2 ± 1.3 and 7.9 ± 1.19, respectively. Pain intensity and functional disability were weakly correlated with grade-3 disc herniation (r = -0.212; P = 0.17; r = 0.197; P = 0.49). In participants with severe LBP, pain intensity was also weakly correlated with functional disability (r = 0.159; P = 0.51) **(Table 3)**.

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

	'r' Value	Interpretation
Pain & Disability	0.159	Weak Correlation
Pain & MSU	-0.212	Weak Correlation
Disability & MSU	0.197	Weak Correlation

* MSU – Michigan State University Classification.

Assessment of clinical significance of anatomical abnormalities detected by MRI technology, present study examined the clinical symptoms of grade-3 disc herniation individuals and clinically correlated them with MRI.

The most common musculoskeletal problem is chronic low back pain, and disc herniations are a serious health problem [22]. Low back pain is caused by various causes, but lumbar disc degeneration is the most common, and disc herniation is caused by degeneration of the disc. In lumbar disc degeneration, A nerve root compromise can be graded most accurately with MRI. the currents reserarch comprised both males and females, unlike previous studies that only included males [23-25].

The cause of chronic low back pain can be various, including modification in relation to age physical activity, and history [26]. Obese patients had a 5.7-fold greater chances of affection by LBP than normal subjects when compared to those with a normal body mass index [27]. Additionally, lifestyle contributes to the emergence of cLBP. One study reach to conclusion that those who train lightly have a higher risk of developing severe back pain than those who exercise vigorously [27].

We found that demographic and clinical variables, as well as MRI fcators, are weakly related to pain intensity and disability in both males and females. The findings of our study were in line with an autopsy study of 647 lumbar spines that revealed disc degeneration is frequent at levels L4-L5 [28]. Pathology usually occurs at L4-L5 but not to the same degree as previously reported [29]. There is a relation amongst pain intensity, functional disability, and cLBP, but the correlation is weak in this study [30]. Possibly because of the young age of the patients, in our study, the mean age was 39 years and 11.7 years. According to literature, pain intensity is a major variable in predicting disability among chronic low back pain patients in a multivariate analysis [31]. A disability score is the most reliable method of measuring the intesity of back pain. Moreover, it helps us understand how acute pain transforms into chronic pain [32] as well as acts as a factor of function like resuming to work [33]. A herniated disc may cause more clinical manifestations and a higher incidence of disability [34]. It was seen that in our study that pain level had a weak correlation with disability, contrary to previous studies which found that disability was correlated with pain level as well as with depression, fatigue, psychosocial factors, financial status, and unemployment [35].

Patients suffering from chronic low back pain can benefit from MRI imaging of the lumbar spine, which is done in an upright position in order to detect disc degeneration [36]. Around 30% of disc abnormalities were found in MRI studies of asymptomatic subjects [37] and the incidence of LBP in these subjects are high [38] Degenerative findings in spine images and their clinical significance have been the subject of many studies in the literature [39]. The long-term relationship between degenerative changes in the spine and disability has also been studied but in limited numbers [40]. It has been found that protrusion of the discs and bulges are highest in the 5th and 6th decade [41], as we also found in our study. A major limitation of the current research was the little sample size and also it was done in in one base. In addition, this study did not assess BMI and psychosocial factors like depressed state, panic, economical level, smoking habits, etc. This study didn't include subjects who were asymptomatic (control group).

Conclusion

The current study indicates that grade-3 disc herniations in the lumber spine do not correlate with pain intensity or functional disability among subjects with severe chronic low back pain. As a result, we encourage clinicians to extend the correlation between disc herniation on MRI and clinical symptoms in individuals who suufer from pain from the lower back.

ACKNOWLEDGMENTS: The authors take the opportunity to thank all the participants of this study and the MRI Technicians and the nurse who helped in taking the MRI for the patients.

CONFLICT OF INTEREST: None
FINANCIAL SUPPORT: None
ETHICS STATEMENT: None

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