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The Efficiency of MRI in Determining the Lower Back Pain associated with lumbar disc pathology

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The Magnetic Resonance Imaging (MRI) examination has proven to be the preferred examination in the assessment of patients with low back pain. MRI is a non-invasive imaging technique with excellent spatial and contrast resolution. The objective of this study was to describe the efficiency of MRI in determining lower back pain and classify the range of lumbar disc pathology in our geographical region. In this study, 80 patients were included and their consent was obtained. Patients reported their intensity of back and leg pain in Visual Analogue Scale (VAS) and recorded their disability in the Roland Morris Disability Questionnaire (RMDQ-Arabic version). Clinical examination of the spine and the lower extremity was done, followed by MRI for all all the patients. The degree of the disc displacement and nerve root compression was graded according to the Michigan State University (MSU) classification of disc herniation. Correlation between the pain intensity (VAS), Functional Disability (RMDQ) and grade-2 disc herniation in MRI were measured with Pearson correlation coefficient. Pain intensity (VAS) pain did not correlate with age of the patient (r = 0.03) and duration of their LBP (r = 0.01). Similarly, the disability index (RMDQ) also did not correlate with age of the patients (r = 0.12) and duration of their LBP (r = 0.03). Pain intensity (VAS) however has correlation with the disability (r = 0.32). Level of the disc herniation did not correlate with pain (r = 0.14) and disability (r = 0.03)The level of disc herniation is not correlated with either level of pain or level of functional disability; as a result, it is prudent to correlate the clinical symptoms of the patients with an MRI before determining the course of treatment for the patient.

Keywords: Magnetic Resonance Imaging (MRI), Low Back Pain, Lumbar Disc Pathology, Visual Analogue Scale (VAS)

INTRODUCTION

The prevalence of low back pain (LBP) is high in developed countries, where two thirds of adults suffer from back pain.(1) It has been reported that back pain is one of the most prevalent health problems in all parts of the world, affecting people of all ages and having severe socioeconomic consequences.(2) In addition to herniated disks, infections, inflammation, osteoporosis, fractured bones, and neoplastic diseases, there are other pathophysiological mechanisms that can cause it. Additionally, there is the possibility that it is not specific.(3) It is well known that many low back pain conditions are mechanical in nature. In some cases, these medical conditions can be caused by excessive stress, strain, trauma, or deformation of the spine as a result of excessive strain. Low back pain is strongly associated with high health care costs and decreased productivity, both of which have a negative economic impact. (4) The prevalence of depression and low quality of life are also widely recognized as being associated with low back pain. Thus, it is imperative that the causes of low back pain be investigated.(5)

There is considerable evidence that suggests that there may be a connection between backbone diseases and unspecified causes, so it is vital to be aware that they may be connected.(6) It is also important to note that many imaging studies will be insufficient if no clinical implications are evident. A radiology scan was employed to examine the backbone and its components during the assessment of patients suffering from low back pain.(7) When back pain is associated with appropriate clinical symptoms, an imaging study in radiology can be useful in analysing the case.(8) In

patients with neurological defects, persistent pain despite appropriate treatment, urinary incontinence and/or faecal incontinence, radiography is recommended.(8)

The use of imaging for low back pain patients can aid physicians in identifying the source of the pain.(9) The various radiological investigations must be performed as early as possible in order to diagnose the underlying cause of LBP.(10) In addition, radiography plays a significant role in diagnosing and treating low back pain caused by a variety of disorders.(11) The use of interventional radiology for the treatment of vascular malformations and malignancies as an adjuvant or sole treatment option continues to grow as interventional radiology advances.(12) Magnetic resonance imaging (MRI) has become the preferred method for diagnosing abnormal lumber conditions, in spite of the fact that there are many different types of imaging available.(13)

The use of MRI is a non-invasive, accurate method for evaluating the morphology of the lumbar spine. Currently, it is commonly used in the treatment of LBP symptoms to assess the relationship between findings on an imaging examination and symptoms.(14) It has become a standard radiology procedure in recent years to perform MRI scans on patients suffering from lower back pain. This method is more reliable than CT because it is non-invasive and does not require the use of ionizing radiation. Further, this imaging modality provides excellent information regarding the height and lack of contrast of the lumbar spine.(7)

Multiple changes were observed to occur in the spine, including changes to the vertebrae and intervertebral discs. Those suffering from low back pain were more likely to experience changes in the paravertebral spine.(15) It is possible to detect degenerative changes and anatomical abnormalities with MRI, however, there is no clear indication as to whether these changes have clinical implications.(16) In order to determine whether clinical pain is associated with lumbar MRI findings in patients with lower back pain, this study examines the lumbar MRI findings in patients with lower back pain.(17) In spite of the fact that MRI evaluation is not available in all areas of the country, it is one of the most expensive tests that most individuals cannot afford. At present, few studies have been conducted in this region to determine the spectrum of pathology associated with lumbar discs.

MATERIALS AND METHODS

A cross-sectional study was conducted in January to April 2022 at King Khalid Hospital in Hail, Saudi Arabia. A total of 80 eligible participants reported sciatica along with grade 2-disc herniations, according to the Michigan State University classification. The study included participants with LBP of both genders with radiating pain, aged between 20 and 60 years, willing to participate in the study, and without any cognitive impairment. Participants with specific causes for their LBP such as a tumour, injury, spinal deformity [scoliosis, kyphosis, spondylolisthesis], trauma, vascular disease, rheumatoid arthritis, fracture, infection, pregnancy, congenital abnormalities, ankylosing spondylitis, hernia, visceral Problems, fibromyalgia, and myofascial pain were excluded.

The following demographic data was collected and recorded: age, gender, address, lifestyle, education level, smoking habits, and dietary habits. Detailed assessments were performed in order to determine the duration, location, radiation, aggravating and relieving factors of sciatica pain. In addition, medical and neurological examinations were conducted. In order to diagnose disc herniation, the straight leg raise [SLR] test was performed and pain between 30° and 70° of elevation was considered positive. The survey included visual analog scales [VAS] for back and leg pain intensity (0 = no pain; 10 = severe excruciating pain and the Rolland Morris Disability Questionnaire [RMDQ] for disability (low score = no disability; high score = severe disability.

Pain Intensity:

In this study, participants were asked to indicate the level of pain they are currently experiencing by using a visual analogical scale (VAS), which includes a 10-cm line, with the left extremity indicating "no pain" and the right extremity indicating "unbearable pain". The higher the value, the more intense the pain.

Functional Disability

The Rolland Morris Disability Questionnaire (RMDQ) is used in order to measure the functional disability associated with low back pain, because it is a functional scale designed to be used in evaluating how low back pain impacts daily activities. As a measure and an evaluation tool for low back pain, the RMDQ is a useful tool that has been shown to be valid and useful, even though there are a variety of useful functional questionnaires available for this purpose. (A valid Arabic version of the RMDQ is also available to further understand the study population). As part of the functional activity, subjects are asked to select the statement that best describes their symptoms based on the information presented to them. The final score is calculated by taking the sum of all the ticked boxes and adding them together. The score ranges from 0 (no disability), 11 (mild), 18 (moderate), or 24 (severe) relying on the questionnaire that is used.(18)

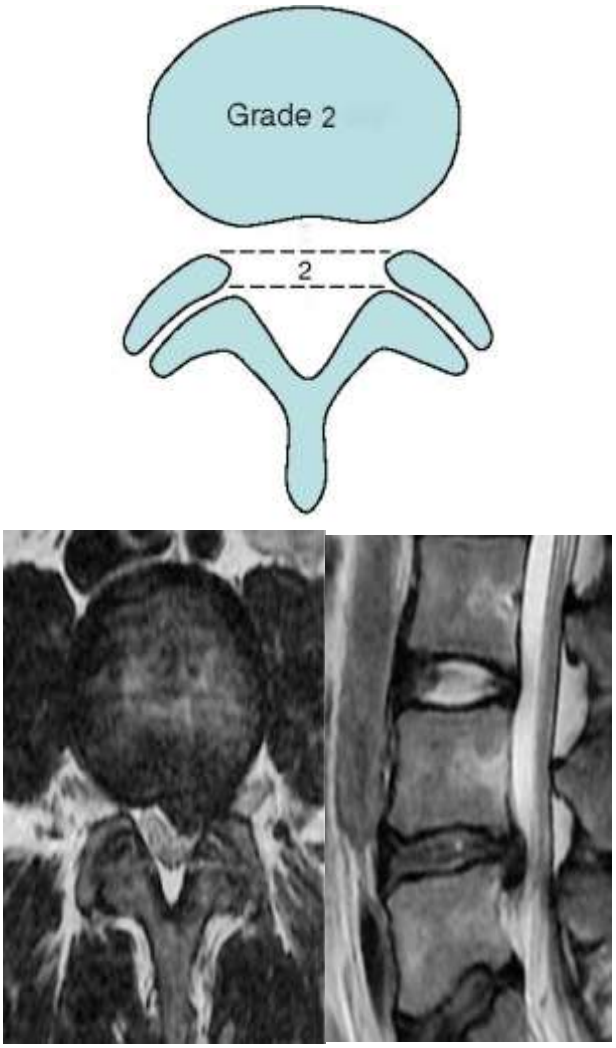
Spinal Magnetic Resonance Imaging (MRI):

In the supine position, all participants underwent spinal MRI diagnostic imaging using an Avanto 1.5 T MRI machine, Siemens, Erlangen, Germany, with an 18-element coil installed on the surface of the body.

A sagittal image was taken before and immediately following intravenous injection of gadolinium diethyl enetriaminepenta-acetic acid (0.1 mmol/kg Gd-DTPA; Schering, Berlin, Germany) with a repetition time/echo time (TR/TE) of 4000/95 ms (T2-weighted) and an axial image with a TR/TE of 640/14 ms (T1-weighted).

An analysis of frequency-selected fat saturation was used

in the post-contrast axial images. For sagittal and axial images, a field of view of 30 cm and 20 cm respectively, and a matrix of 192 by 256/two excitations, respectively, were included in the technical specifications. Two experienced musculoskeletal radiologists evaluated and interpreted the MRI changes (L1 to S1) using standardized evaluation



(b) **(c)**

Figure 1: (a) Grade 2 disc herniation with medium impact on nerve compression, (b) MRI axial T_2 weighted image and (c) sagittal T_1 shows L4-L5 lumbar disc herniation.protocols. A lumbar disc herniation on MRI was measured using the Michigan State University [MSU] Classification. MSU Classification reports size and location in three precise increments, described simply as 1-2-3 and A-B-C (figure), all taken from a single measurement of the intra-facet line. (19)

RESULTS

The present study evaluates the relation between pain intensity on VAS, disability on RMDQ, and the level of the disc herniation on MSU grade - 2 classifications in patients with disco genic low back pain. Totally 80 participants with grade-2-disc herniation were evaluated. The mean age of the patients was 34 ± 9.2 years. The mean duration of the symptoms were 3.2 ± 0.3 months. Their mean height and weights were 150±8.9 cms and 50 ± 8.4 kgs respectively.

The mean VAS score of these patients was 7.9 ± 1.5 and the mean Rolland Morris Disability score was 15.3 ± 2.7. Pain intensity measured with VAS score in the patients with L4-L5 level and L5-S1 level disc herniation was recorded as 7.1 ± 1.1 and 6.9±1.2, respectively. The distribution of the number of participants and its percentage according to the characteristics was documented [Table 1].

There was no significant relationship between the level of lumbar disc herniation and gender of the patients (r = 0.11; *P* = 0.17). Pain intensity (VAS) pain did not correlate with age of the patient (r = 0.03; *P* = 0.76) and duration of their LBP (r = 0.01; *P* = 0.82). Similarly, the disability index (RMDQ) also did not correlate with age of the patients (r = 0.12; *P* = 0.02) and duration of their LBP (r = 0.03; *P* = 0.22). Pain intensity (VAS) however has correlation with the disability (r = 0.32; *P* = 0.005). Level of the disc herniation did not correlate with pain (r = 0.14; *P* = 0.01) and disability (r = 0.03; *P* = 0.001) [Table. 2].

Table 1: Demographic data of the participants

Variables	**N (%)**	**Mean±SD**
Age (years)		34 ± 9.2
Weight (kg)		50 ± 8.4
Height (cm)		150±8.9
Duration (Months)		3.2 ± 0.3
Male/Female		40/40
20 – 29 years	10 [12.5]	
30 – 39 years	20 [25]	
40 – 49 years	20 [25]	
50 – 59 years	10 [12.5]	
Radiation of pain in legs		
Yes	50 [62.5]	
No	30 [37.5]	
Body Mass Index [BMI]		
Normal	47 [58.75]	
Overweight	28 [35.01]	
Obese	5 [06.25]	
Disc Herniation		
L4 – L5	23 [28.75]	
L5 – S1	57 [71.25]	
MSU [Grade – 2]		
A	7 [08.75]	
B	22 [27.50]	
AB	51 [63.75]	

Table 2: Correlation between pain, disability and level of disc prolapse.

Parameters	**'r' Value with P value**	**Interpretation**
Pain & Disability	r = 0.32;	Weak Correlation

	$P = 0.005$	
Pain & MSU	r = 0.14; $P = 0.01$	Negligible Correlation
Disability & MSU	r = 0.04; $P = 0.001$	Negligible Correlation

DISCUSSION

An MRI study of patients with grade-2 disc herniation was conducted in order to evaluate the clinical significance of anatomical abnormalities identified by this radiographic technique by assessing clinical symptoms, such as pain and disability, in order to assess the clinical significance of anatomical abnormalities. The degree of disc herniation in patients with discogenic low back pain was correlated to the intensity of the pain, the RMDQ, and the severity of the sciatica symptoms among patients with discogenic low back pain.

Sciatica and low back pain can be caused by disc degeneration, which may be caused by age-related changes, physical activity, and a child's medical history.(10,20,21) Compared to subjects without overweight or obesity, those with a higher body mass index were more likely to have low back pain.(22–24) Similarly, lifestyle also contributes to developing low back pain.(25–27) It has been shown that individuals who engage in mild physical activity have a higher risk of experiencing low back pain than those who engage in strenuous activity.(28,29) The retrospective relationship between activity and point prevalence of chronic low back pain was assessed using a short recall questionnaire. The authors reported a U-shaped relationship, in which both high and low levels of activity increased the probability that a person would report chronic pain in the future, especially in women.(30) In only one longitudinal study, activity levels were stratified according to low, moderate, and high levels at baseline and self-report measures were used to determine the relationship between activity levels and LBP outcome.(31)

The results of this study indicate a weak correlation between clinical parameters and MRI parameters and pain intensity and disability in both males and females. It has been reported in several studies that disc degeneration is most commonly observed at the L4,L5 and S1 levels. (32–35) However, similar findings were also observed in the present study. As a result of low back pain, pain intensity always influences functional disability, whereas in the present study, pain intensity and disability did not have a strong correlation. There may be a reason for this, as the study had a smaller sample size and more samples of younger adults. Among chronic low back pain patients, pain intensity was shown to be a major determinant of disability in a study. In this study, 53.0% of the variance in disability caused by CLBP at 12 months was explained by the prognostic model. A higher level of pain intensity, higher levels of fear-avoidance work, and a higher age are all associated with greater disability. It was predicted that individuals with no additional somatic symptoms would have a lower disability level. Pain intensity at 12-month follow-up was explained by higher disability at baseline, while not being in paid employment appeared protective (25.7% of variance explained).(36)

Disability is the most effective clinical evaluation tool for measuring the severity of back pain. It determines whether a patient has progressed from acute to chronic pain and is also a significant factor in determining a person's ability to function. (37) Herniated discs may sometimes cause more clinical symptoms and a higher incidence of disability. It was found that pain intensity does not seem to affect disability in this study, in contrast to previous research that found a weak correlation between pain intensity and disability.Previous research also showed a correlation between disability and depression, fatigue, psychosocial factors, financial position, and unemployment.(38,39)

CONCLUSION

Based on the findings of this study, it can be concluded that grade-2 herniations in the lumbosacral spine have weak correlations with both the degree of pain intensity and functional disability in patients with severe low back pain. As a result, it is recommended that some demographic variables be assessed objectively in order to obtain information about the outcome of the procedure and the level of herniation.

CONFLICT OF INTEREST

The authors report that there are no conflicts of interest inthis work. There is no financial support or sponsorship for this research.

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AUTHOR CONTRIBUTIONS

QTA contributed to study design and literature search. EA and WA definition of intellectual content. MTA and OA edited and reviewed the manuscript. SK, SAA and MAA prepared the manuscript. NE and IAF data acquisition. All authors read and approved the final version

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