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An MRI longitudinal study in low back pain patients: assessment of Disc Herniation Grade 3

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Magnetic Resonance Imaging (MRI) is used to diagnosis disc herniation. In order to ascertain whether MRI findings at baseline and follow-up can be used to predict future changes in low back pain (LBP) among patients with severe disc prolapse.(grade 3-disc herniation).A total of 100 patients participated in this prospective longitudinal study at one center, all of whom provided their informed consent. Patients were asked to rate the severity of their back pain using the Visual Analogue Scale (VAS) and to fill out the Roland Morris Disability Questionnaire to have their disability assessed. Next, an MRI scan with a standard sequences, including T1-weighted axial images and T2-weighted sagittal images, was performed on each participant to evaluate their spines. 66 volunteers had second MRI scans for LBP patients within two years of their initial MRI scan. The presence of disc herniation and LBP patients with severe prolapsed discs (grade 3-disc herniation) were found to have weak correlations with age, VAS scores, disability index, and other variables. There was a weak correlation between pain and disability and Grade 3 (r=0.09, r=0.08). Furthermore, the majority of MRI results showed no discernible correlation between pain and disability with the severity of future LBP (r=0.29, p=0.24).The study concluded that there is no statistically significant correlation between the MRI results in ongoing and upcoming studies and the degree and location of lumbar disc herniation, pain, and disability for patients with low back pain who have grade 3 disc herniation.

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

INTRODUCTION

About 80% of individuals suffer from chronic low back pain (LBP). It is the primary cause of disc degeneration and impairments as well (Clark et al. 2018). One of the most trustworthy imaging methods for diagnosing and evaluating the condition of the intervertebral discs is magnetic resonance imaging (MRI). This technique allows for the assessment of pathological processes and levels of degeneration, including disc herniation and inflammation of the endplates (Jarvik et al. 2001, McNee et al. 2011,

Borenstein et al. 2001). Furthermore, MRI is a frequently used imaging technique for determining how the intervertebral disc and the surrounding soft tissues and nerves relate to one another (Hancock et al. 2017). Thus, pathologies can also be evaluated using the spinal cord and canal (Boden et al. 1990, Boos et al. 1995). When determining the shape, size, extent, and location of disc herniations in the body, MRIs are especially helpful (Boos et al. 2000). The cause of LBP might not be identified by MRI results alone (Clark et al. 2018, Jarvik et al. 2001, McNee et al. 2011, Borenstein et al. 2001, Hancock et al. 2017, Boden et al. 1990, Boos et al. 1995, Boos et al. 2000).

Typically, patients with sciatica who have recurrent or persistent symptoms would undergo an MRI to determine whether a lumbar disc prolapse has occurred (Fardon et al. 2001, Duncan et al. 2007). Patients should have an MRI when they have had severe symptoms for at least 6–8 weeks and conservative treatment is not working to relieve them (Clark et al. 2018, Jarvik et al. 2001, McNee et al. 2011, Borenstein et al. 2001, Hancock et al. 2017, Boden et al. 1990, Boos et al. 1995, Boos et al. 2000).

Surgery may be necessary for these patients, and MRIs can be helpful in determining how the slipped disc impairs the nerve roots. The correlation between MRI findings and symptoms experienced by LBP patients is still up for debate, as prior studies have demonstrated that patients with disc herniation even lacked apparent symptoms (Hancock et al. 2017). These aberrant MRI findings may require invasive treatments like epidural injections or surgery (Boden et al. 1990). There was limited Studies that examine the relationship between pain intensity and long-term LPB using follow-up MRI techniques them (Clark et al. 2018, Jarvik et al. 2001, McNee et al. 2011, Borenstein et al. 2001, Hancock et al. 2017, Boden et al. 1990, Boos et al. 1995, Boos et al. 2000, Hancock et al. 2017). Therefore, In patients with severely prolapsed discs (grade 3-disc herniation), the current study aims to investigate the predictive utility of initial MRI findings and follow-up results in terms of LBP advancement.

MATERIALS AND METHODS

This study was carried out between 2020 and 2022 at the King Khalid Hospital in Hail, Saudi Arabia, in the Radiology Department. It was a prospective longitudinal study. The total number of sciatica sufferers in the study was 100. These patients were categorized as grade 3 based on the location and size of the herniated disc within the spinal canal. Patients with a dermatomal pattern of pain distribution were the only ones included in the MRI study. Two years after the first MRI scan, 66 people had a follow-up scan optimized for patients with low back pain.

Participants with sciatica who do not have any cognitive impairments were eligible for inclusion in the study; participants of both sexes and ages (20–60) were included. Participants with tumors, injuries, rheumatoid arthritis, fibromyalgia, myofascial pain, pregnancy, congenital abnormalities, ankylosing spondylitis, hernias, visceral issues, fibromyalgia, myofascial pain, and those pregnant were excluded from the study. The participant's age, gender, residence, lifestyle, educational background, smoking history, and eating habits were all included in the data. A detailed analysis was conducted of the duration, location, radiation, triggers, and factors that reduce sciatic pain.

Procedure

Pain Severity Assessment: Participants indicated how much pain they were currently experiencing using a visual analog scale (VAS), which ranged from "no pain" to "unbearable pain".

Functional Impairment Assessment: To assess functional disability, the Rolland Morris Disability Questionnaire (RMDQ) was employed. This particular survey was created to gauge how daily activities were impacted by low back pain. An authenticated Arabic RMDQ version was utilized to gain additional insights into the study population. The statements that best described their current back pain symptoms were selected by patients during functional exercises. There was no disability indicated by a score of 0 and severe disability indicated by a score of 24.

Spinal MRI Procedure:

Using a 1.5 T MRI scanner with a 24-element body spine surface coil attached, all participants were scanned while they were supine.. The gadolinium diethyl enetria mine penta-acetic acid (Gd-DTPA) was administered both prior to and following the acquisition of T1-weighted axial images and T2-weighted sagittal images. The examination and interpretation of the MRI scan results from L1 to S1 was done by two highly qualified musculoskeletal radiologists with over ten years of experience. Lumbar disc herniation on MRI scans was assessed using the Michigan State University (MSU) Classification. This categorization scheme takes into account the herniation's location and size using a single intra-facet line measurement.. The recommendations of the North American Spine Society, the American Society of Neuroradiology, and the American Society of Spine Radiology were also followed for the classification of lumbar disc pathology .(Figure 1).

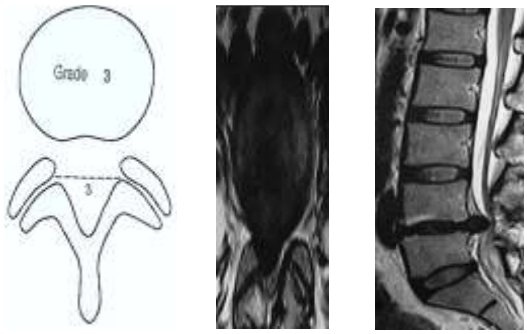

Figure 1: (a) Grade 3 disc herniation with medium impact on nerve compression, (b) MRI axial T_2 weighted image and (c) sagittal T_1 shows L4-L5 lumbar disc herniation.

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.

RESULTS

The research involved 100 patients with an average age of 37 ± 9.2 years. The participants had an average height of 173.4 centimeters and an average weight of 85.6 kilograms. The baseline assessment showed a

mean VAS score of 7 ± 1.3 and a mean RMDQ of 14.9 ± 4.3. In the follow-up evaluation, the mean VAS score was 6.8 ± 1.5, and the mean RMDQ score was 14.6 ± 3.4. The correlation coefficient (r) between the initial and subsequent VAS scores was 0.09, 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 7.3 ± 1.0 and 7.1 ± 1.1, respectively. (Table)displays the patient distribution according to variables like age, gender, BMI, length of symptoms, radiation to the pain area, and disc herniation. Three groups of patients were created according to the location and size of the herniated disc(Table 2)

Table 1: Distribution of the subjects with their characteristics

Characteristics	Variables	N = 100 n [(n/N) %]
Age	20 – 29 years	28 [28%]
	30 – 39 years	45 [45%]
	40 – 49 years	22 [22%]
	50 – 59 years	5 [5%]
Gender	Male	52 [52%]
	Female	48 [48%]
Radiation of Pain into legs	Yes	100 [100%]
	No	0 [0]
Body Mass Index [BMI]	Normal	81[81%]
	Overweight	17 [17%]
	Obese	2 [2%]
Disc Herniation	L4 – L5	78 [78%]
	L5 – S1	22 [22%]

* MSU – Michigan State University Classification.

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

Characteristics	Variables	N = 100
MSU [Grade – 1]	A	64
	B	26
	AB	10
	Total	100

No significant correlation was found between the lumbar disc herniation level and patient sex (r = 0.16; P = 0.09). Pain intensity (VAS) did not exhibit a relationship with patient age (r = 0.08; P = 0.12) or the duration of their LBP (r = 0.01; P = 0.7). Additionally, the disability index (RMDQ) did not show a correlation with patient age (r = 0.4; P = 0.02) or the duration of their lower back pain (r = 0.07; P = 0.4). However, pain intensity (VAS) was correlated with disability (r = 0.45; P = 0.005). There was no association between the degree of disc herniation and either pain (r = 0.19; P = 0.01) or disability (r = 0.09; P = 0.01).

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 3 disc herniation and both pain intensity (r = 0.09; P = 0.01) and functional disability (r = 0.08; P = 0.02). Similarly, during the follow-up examination, a weak correlation was observed between grade 3 disc herniation and pain intensity (r = 0.29; P = 0.02) as well as functional disability (r = 0.24; P = 0.02) (Table 3).

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 = 0.09; P = 0.01	Weak Correlation
Disability & MSU	r = 0.08; P = 0.02	Weak Correlation
Follow up exam		
Pain & MSU	r = 0.29; P = 0.02	Weak Correlation
Disability & MSU	r = 0.24; P = 0.02	Weak Correlation

DISCUSSION

In this study, The size and location of lumbar disc herniation, pain, and disability in LBP patients with disc herniation grade were found to be unrelated to MRI scan results in both ongoing and upcoming studies. The intervertebral discs can be diagnosed and their condition assessed with high accuracy using magnetic resonance imaging (MRI). The pathological processes and degrees of degeneration, such as disc herniation and endplate inflammation, can be evaluated using this technique (Jarvik et al. 2001, McNee et al. 2011, Borenstein et al. 2001).

It is difficult to draw direct comparisons with prior research because of the substantial variations in the study design, sample origin, duration of follow-up, and pain assessment amongst the exams examining the connection between MRI degenerative findings and low back pain. Additional MRI findings were discovered in older adults with and without symptoms, which is in line with previous research (Duncan et al. 2007, Hancock et al. 2007, Boden et al. 1990).

In contrast to Boden et al. every participant in our study stated that they experienced pain that was referred to their legs. It revealed that a significant proportion of asymptomatic adults with spinal canal stenosis, bulging discs, disc degeneration, and disc herniation were between the ages of 20 and 80 (Boden et al. 1990).

Study participants with symptomatic disc degeneration who were young and physically fit

showed higher rates of disc degeneration, disc herniation, and modulic change. However, no correlations were discovered (Boos et al. 2000, Borenstein et al. 2001, McNee et al. 2011, Suri et al. 2014, Udby et al. 2021, Simo et al. 2020). various parameters, such as the definition of low back pain, sample characteristics, and research design, could be to contributed for the not consistent results (Boos et al. 2000, Borenstein et al. 2001, McNee et al. 2011, Suri et al. 2014, Udby et al. 2021, Simo et al. 2020) . Despite prior longitudinal studies involving individuals with current pain and small sample sizes, no significant correlation was observed during follow-up between specific MRI findings and low back pain (Boos et al. 2000, Borenstein et al. 2001, McNee et al. 2011, Suri et al. 2014, Udby et al. 2021, Simo et al. 2020).

In agreement with Borenstein and others. Research has shown a correlation between the development of low back pain and spinal canal stenosis, disc herniation, disc degeneration, and disc bulge in individuals who had never experienced pain (Borenstein et al. 2001) . Our findings confirm those of past research that failed to find any link between MRI results and (LBP). A small number of research have examined the connection between future LBP and the quantity of MRI findings (Borenstein et al. 2001). A small number of studies have also examined the connection between MRI results and pain in the future (Borenstein et al. 2001) . Hancock carried out a study with associates (Hancock et al. 2017). In contrast to individuals who did not report any initial pain, patients exhibiting three or more MRI findings were more likely to experience recurrent lower back pain (Boos et al. 2000, Borenstein et al. 2001, McNee et al. 2011, Suri et al. 2014, Udby et al. 2021). Conversely, McNee and associates. found that, after 18 months, there was no relationship between the number of MRI findings and lumbar pain in patients who had previously experienced lumbar spine problems (McNee et al. 2011) According to the results of our study, participants who underwent MRI scans had higher average pain severity scores. However, there was little to no correlation (15–20) among those who first experienced LBP (Boos et al. 2000, Borenstein et al. 2001, McNee et al. 2011, Suri et al. 2014, Udby et al. 2021, Simo et al. 2020, Alshammari et al, 2024, Alshammari et al. 2024).

CONCLUSIONS

Based on ongoing and upcoming studies, there is no statistically significant correlation found between lumbar disc herniation position and magnitude, pain, and disability in LBP patients with disc herniation grade 3. Given the substantial variations in their design, sample origin, length of follow-up, and pain assessment, it is difficult to draw direct comparisons between the MRI degenerative discoveries and low back pain and previous research

Supplementary materials

The supplementary material / supporting for this article can be found online and downloaded at: https://www.isisn.org/article/

Author contributions

Conceptualization, Q.T.A; methodology, Q.T.A and A.M.A.; formal analysis, F.H.A and R.M.A; investigation, M.F.A and M.M.A; writing-original draft preparation, Q.T.A; M.A. and H.S.A; writing-review and editing, Q.T.A. and F.M.H; supervision, Q.T.A. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement

Not applicable.

Data Availability Statement

All of the data is included in the article/Supplementary Material.

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Conflict of interest

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

resulting from any ideas, methods, instructions or products referred to in the content.

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REFERENCES

Alshammari QT , Alghamdi RM , Alshammari OH , Alkayyadi ZT , AlAqeel FH , Albakri BS , Alqarni MS, Ali S Alyami7 , Alshammari AT. An MRI longitudinal study in Low back Pain Patients: Assessment of Disc Herniation Grade 2. Journal of Positive Psychology & Wellbeing. 2024, Vol. 8, No. 3, 67 – 72

Alshammari QT, Alqarni M, Alshammari SF, Abo Thaman BA, Alghamdi AA, Alsubaie MM, A Correlation between MRI findings in current and future Disc Herniation Grade 1- Amongst Low Back Pain Patients. Journal of Positive Psychology & Wellbeing. 2024, Vol. 8, No. 2, 196-202

Boden SD, Davis DO, Dina TS, Abnormal magnetic resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation. J Bone Joint Surg Am 1990; 72:403–8.

Boden SD, Davis DO, Dina TS, Patronas NJ, Wiesel SWAbnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation. J Bone Joint Surg Am 1990; 72:403–408.

Boos N, Rieder R, Schade V, Spratt KF, Semmer N, Aebi M.Volvo,1995 Award in clinical sciences. The diagnostic accuracy of magnetic resonance imaging, work perception, and psychosocial factors in identifying symptomatic disc herniations. Spine (Phila Pa 1976) 1995; 20:2613–2625.

Boos N, Semmer N, Elfering A, Schade V, Gal I, Zanetti M, Kissling R, Buchegger N, Hodler J, Main CJ.. Natural history of individuals with asymptomatic disc abnormalities in magnetic resonance imaging: predictors of low back pain-related medical consultation and work incapacity. Spine (Phila Pa 1976) 2000; 25:1484–1492.

Boos N, Semmer, Norbert Dipl Psych, ; Elfering, Achim ; Schade, Volker , Gal, Imre ; Zanetti, Marco Kissling, Rudolf , Buchegger, Niklaus*, Hodler, Juerg ; Main, Chris J.Natural history of individuals with asymptomatic disc abnormalities in magnetic resonance imaging: predictors of low back pain-related medical consultation and work incapacity. Spine (Phila Pa 1976) 2000; 25:1484–92.

Borenstein DG, O'Mara JW Jr, Boden SD, Lauerman WC, Jacobson A, Platenberg C, Schellinger D, Wiesel SW. value of magnetic resonance imaging of the lumbar spine to predict low back pain in asymptomatic subjects: a seven-year follow-up study. J Bone Joint Surg Am 2001; 83:1306–11.

Clark, S.; Horton, R. Low Back Pain: A Major Global Challenge. Lancet 2018, 391, 2302

Duncan R, Peat G, Thomas E, Hay E, McCall I, Croft P Symptoms and radiographic osteoarthritis: not as discordant as they are made out to be? Ann Rheum Dis 2007; 66:86–91.

Fardon DF, Milette PC. Nomenclature and classification of lumbar disc pathology: recommendations of the combined task forces of the North American Spine Society, American Society of Spine Radiology and American Society of Neuroradiology. Spine (Phila Pa 1976) 2001;26(5): 93-113.

Hancock MJ, Kjaer P, Kent P, Jensen RK, Jensen TS Is the number of different mri findings more strongly associated with low back pain than single MRI findings? Spine (Phila Pa 1976) 2017; 42:1283–1288

Jarvik JJ, Hollingworth W, Heagerty P, Haynor DR, Deyo RA. The Longitudinal Assessment of Imaging and Disability of the Back (LAIDBack) Study: baseline data. Spine. 2001;26: 1158–1166.

Philip McNee, James Shambrook, E Clare Harris, Miranda Kim, Madeleine Sampson, Keith T Palmer & David Coggon. Predictors of long-term pain and disability in patients with low back pain investigated by magnetic resonance imaging: a longitudinal study. BMC Musculoskeletal Disorder 2011; 12:234.

McNee P, Shambrook J, Harris EC, Kim M, Sampson M, Palmer KT, Predictors of long-term pain and disability in patients with low back pain investigated by magnetic resonance imaging: a longitudinal study. BMC Musculoskelet Disord. 2011;12:234.

Sääksjärvi S, Kerttula L, Luoma K, Paajanen H, Waris E.Disc degeneration of young low back pain patients: a prospective 30-year follow-up MRI study. Spine (Phila Pa 1976) 2020;45:1341–7.

Suri P, Boyko EJ, Goldberg J, Forsberg CW, Jarvik JG,Longitudinal associations between incident lumbar spine MRI findings and chronic low back pain or radicular symptoms: retrospective analysis of data from the longitudinal assessment of imaging and disability of the back (LAIDBACK). BMC Musculoskeletal Disorder 2014; 15:152.

Udby PM, Ohrt-Nissen S, Bendix T, Brorson S, Carreon LY, Andersen MØ.The association of MRI findings and long-term disability in patients with chronic low back pain. Global Spine J 2021; 11:633–9.