Clinical significance of Magnetic Resonance Imaging (MRI) of lumbar spine in lower backache: An observational study.

Madihs Ariff*

Department of Physical Therapy (DPT), University of Management and Technology Lahore, Pakistan.

Abstract

Objective: To assess the clinical significance and effectiveness of lumbar Magnetic Resonance Imaging (MRI) in patients with chronic lower backache and radiculopathies related to it.

Methodology: This descriptive cross-sectional study was conducted through a non-probability convenient sampling technique. This included 90 patients of both genders, between 20 to 75 years of age with a history of low back pain, numbness, and unilateral or bilateral lower limb radiculopathy, whereas excluded patients with a history of trauma, infection, tumor, metastasis, and vascular malformation. Magnetic Resonance Imaging (MRI) Lumbar (L) spine was performed by Hitachi Airis Elite 3 tesla MRI scanner. The scans obtained at L2-L3, L3-L4, L4-L5, and L5-S1 levels. A Performa was used to collect data, and the Statistical Package for the Social Sciences (SPSS) version 21 was used for statistical analysis. Ethical approval and informed consent were maintained.

Result: Out of a total of 90 patients, the mean age of the patients observed was 44.64 ± 15.67 years. 36.7% complained of bilateral lower limb radiculopathies, 48 (53.5%) patients had numbness, and 72 (80%) patients showed signs of disc desiccation and osteophytes formation, whereas 18 (20%) patients showed multi-level disc osteophyte complexes. 82 (91.1%) patients had diffuse disc bulge at L5-S1 spinal level. Neural foramina compromised in 90 (100%) patients at the L4-L5 level due to which there was a nerve root compression in 89 (98.9%) patients at this level. They mostly spared the L2-L3 level. About 89 (98.9%) patients had no facet joint hypertrophy at the L2-L3 level, and 100% of people did not show any significant ligamentum flavum hypertrophy at this level.

Conclusion: Our study illustrated that the frequency of low back pain is much higher in both genders. Disc desiccation was frequent in patients with lower back pain. The most common targeted sites were L4-L5 and L5-S1 due to the nerve root, foraminal canal compressions, and spinal canal stenosis.

Keywords: Lower backache, Magnetic resonance imaging, Lumbar spine.

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Introduction

The spine acts like a pillar for our body, and any ignorance in diagnosing its pathology can be devastating. Lower backache is a common problem globally and can cause disability. According to the global burden of disease study, the low back pain ranked top in causing disability with a prevalence of 9.4% worldwide.

The back pain is generally one of two categories, i.e., acute that lasts for a few days and weeks, and chronic, that continues for 12 weeks or longer. Acute back pain becomes chronic in 20% of cases [1]. There are multiple causes of back pain, including occupational hazards, obesity, postural imbalance, and age-related changes.

One-third of Pakistani nurses have an occupation-related low back disorder, and 94% of them prefer rest to get better, such ignorance can lead to permanent health problems. Other professionals like doctors between 26-40 years of age with 10-15 years of experience also face musculoskeletal disorders, mostly low back pain [2]. Dermatologists, psychiatrists, physiotherapists, and radiologists also demonstrate LBP symptoms.

Degeneration in the intervertebral disc leads to the degeneration of the facet joints. Disc wears off usually with aging and may not have symptoms mostly and later can cause severe LBP. However, anatomical defects of the spine like end-plate fracture and herniation are easily detected. Such problems are irreversible because discs of an adult have limited healing capability, and it progresses due to physical and biological function [3].

Radiculopathy due to a lumbosacral disc herniation is a displacement of intervertebral disc beyond the boundaries of disc space, and this can cause severe pain or pins and needles sensation or paresis throughout the myotomal or dermatomal levels [4]. Structural abnormalities are usually presented by Magnetic Resonance Imaging (MRI) and help in surgical planning, whereas nerve conduction studies can identify the severity of nerve root damage and aids in postoperative follow-up.

Computed Tomography (CT), discography, and Magnetic Resonance Imaging (MRI) are multiple options for investigating LBP. The clinical symptoms and signs in Chronic Low Backache (CLBA) can be compared by these. However, Lumbar (L) spine MRI shows disc bulges, without extrusions in people without back pain complain, so such findings of MRI

in patients with low backache could be coincidental. MRI can visualize soft tissue structures, for example, disc, nerves, and muscles, which are the possible causes of LBP, but in some cases, it may not identify the source of LBP. It is difficult to guess future LBP from baseline MRI findings.

CT or MRI is considered the most reliable for diagnosing the spinal diseases, but more than one sequence is required to be accurate, for example, T1-weighted and T2-weighted of MRI scans [5]. Positive findings in the neurological examination can be used to predict nerve root compression in the MRI, whereas, such findings of physical examination do not predict abnormal nerve conduction studies. A study supported that MRI has equal or even better sensitivity than other technologies, and it shows super contrast and is more explanatory than computed tomography but also unveil clinically hidden pathologies [6].

Most of the diseases are missed on clinical examination and x-ray alone. A lumbar MRI is a non-invasive procedure that doctors use to help diagnose lower back pain, plan back surgery, or monitor progressive medical conditions, such as multiple sclerosis and degenerative changes of lumbosacral spine were frequent in patients with CLBA. Unlike X-Rays, MRI is a radiation-free test. MRI renders detailed three-dimensional anatomical views of spinal bone and soft tissues [7].

Sometimes, a contrast agent or dye (e.g., gadolinium) is used to highlight and improve the quality of the MR images. An MRI may be necessary to evaluate neurological symptoms, such as radiating pain or back pain that develops in a patient previously diagnosed with cancer. Therefore, the need of MRI is important for the diagnosis of the disease and its treatment [8].

In non-specific low back pain, Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are effective for symptomatic treatment. There is a strong recommendation to follow non-pharmacologic treatment, including thermotherapy, acupuncture, spinal manipulation, but if medication is required, then select NSAIDs or muscle relaxants [9]. Problems related to back pain, including disc degeneration and radiculopathy, remain unnoticed during the economic analysis, making it difficult to evaluate the economic effect of symptomatic disc herniation. Nevertheless, the health care price, absent days at work, and less productivity bring huge economic burden [10].

Chronic lower backache, including radiculopathies, is frequently evaluated by MRI; however, its significance has not been established in the developing country. The purpose of this study was to determine the clinical significance and efficacy of lumbar MRI in patients with chronic lower backache and its associated radiculopathies [11].

Materials and Methods

This was a descriptive cross-sectional study conducted through non-probability convenient sampling technique. A well-designed Performa was used to collect data of 90 patients after taking ethical approval and verbal informed consent [12]. Patients of both genders, between 20 to 75 years of age with a history of low back pain, numbness, and unilateral or bilateral lower limb radiculopathy, were included in the study [13].

Patients with a history of trauma, infection, tumor, metastasis, and vascular malformation were excluded. Duration of symptoms varied from days, weeks, months, years, or without any specific know period [14]. Magnetic resonance imaging (MRI) lumbar spine was performed by Hitachi Airis Elite 3 tesla MRI scanner. Both T1 and T2 sequences of sagittal images were collected. Axial images were received in the T2 sequence parallel to the intervertebral disc, whereas sagittal images were obtained at 4 mm slice thickness with a 0.3 mm inter-slice gap [15].

The L2-L3, L3-L4, L4-L5, and L5-S1 level scans were collected. It has shown findings of neural foraminal and lateral recess narrowing, stenosis, hypertrophy of ligamentum flavum, and facet hypertrophy at the mentioned levels of the spine [16]. The Statistical Package for the Social Sciences (SPSS) version 21 software collected data. The frequencies and percentages were presented from the data [17].

Results

The mean age of 90 patients who met the inclusion criteria was 44.64 years, and 53 (58.9%) were males, whereas the remaining 37 (41.1%) were females. The majority of the patients, 33 out of 90 (36.7%), complained of bilateral lower limb radiculopathy. However, compared to the left lower limb, the radiating pain in the right lower limb is most common, with 23.3%, that is about 21 patients, but the duration of pain is usually unknown in 49 (54.4%) patients.

About 22 (24.4%) patients were having pain for a few months. Out of 90 patients, 48 (53.5%) patients were having numbness. After receiving Magnetic Resonance Imaging (MRI) reports, it had been observed that all patients were having abnormal findings, 72 (80%) patients were having signs of disc desiccation and osteophytes formation, whereas 18 (20%) patients showed multi-level disc osteophyte complexes [18] (Table 1).

Table 1. *Distribution of sample by age, gender, symptoms and Magnetic Resonance Imaging (MRI) finding of disc desiccation or osteophytes complex.*

Variable		**Mean ± SD /**
		n (%)
Age (years)		44.64 ± 15.67
Gender	Male	53(58.9%)
	Female	37(41.1%)
Radiation of pain	Right leg	21(23.3%)
	Left leg	14(15.6%)
	Both legs	33(36.7%)
	Absent	22(24.4%)
Numbness	Yes	48(53.5%)

	No	42(46.7%)
Duration of pain	Days	9(10.0%)
	Weeks	1(1.1%)
	Months	22(24.4%)
	Years	9(10.0%)
	Unknown	49(54.4%)
Disc desiccation/disc osteophyte complexes	Yes	72(80.0%)
	Multi-level disc	18(20.0%)
	osteophyte complexes	

According to the qualitative data analysis, 82 (91.1%) patients were having diffuse disc bulge at L5-S1 spinal level. Neural foramina compromised in 90 (100%) patients at the L4-L5 level due to which there was a nerve root compression in 89 (98.9%) patients at this level. It had been observed that the L2-L3 level is mostly spared from neural foramina compromise and nerve root compression with 95.6% (86 out of 90 patients), and there was no spinal canal stenosis finding in 86 (95.6%) patients [19]. About 89 (98.9%) patients were having no facet joint hypertrophy at L2-L3 level, and 100 percent of people did not show any significant ligamentum flavum hypertrophy at this level. Mild to moderate spinal canal stenosis was present at L4-L5 and L5-S1 levels, with 73 (81.1%) and 85 (94.4%) patients, respectively. The most affected level with ligamentum flavum hypertrophy and facet joint hypertrophy was L5-S1, with 20 (22.2%) and 59 (65.6%) patients, respectively [20] (Table 2).

Table 2. *Distribution of Magnetic Resonance Imaging (MRI) findings at different spinal levels.*

Variable		**Spinal level**			
		L2-L3	**L3-L4**	**L4 –L5**	**L5-S1**
		n (%)	**n (%)**	**n (%)**	**n (%)**
Disc bulging	Diffuse disc bulge	2(2.2%)	20(22.2%)	83(92.2%)	82(91.1%)
	Mild disc bulge	2(2.2%)	37(41.1%)	7(7.8%)	2(2.2%)
	Absent	86(95.6%)	33(36.7%)	0(0.0%)	6(6.7%)
Neural foramina compromise	Yes	4(4.4%)	57(63.3%)	90(100.0%)	84(93.3%)
	No	86(95.6%)	33(36.7%)	0(0.0%)	6(6.7%)
Nerve root compression	Yes	4(4.4%)	34(37.8%)	89(98.9%)	84(93.3%)
	No	86(95.6%)	56(62.2%)	1(1.1%)	6(6.7%)
Spinal canal	Mild	3(3.3%)	39(43.3%)	16(17.8%)	3(3.3%)
stenosis	Mild to moderate	0(0.0%)	11(12.2%)	73(81.1%)	85(94.4%)
	Moderate to severe	0(0.0%)	0(0.0%)	1(1.1%)	1(1.1%)
	Significant	1(1.1%)	1(1.1%)	0(0.0%)	0(0.0%)
	Nil	86(95.6%)	39(43.3%)	0(0.0%)	1(1.1%)
Ligamentum flavum hypertrophy	Yes	0(0.0%)	3(3.3%)	21(23.3%)	20(22.2%)
	No	90(100.0%)	87(96.7%)	69(76.7%)	70(77.8%)
Facet joint hypertrophy	Yes	1(1.1%)	7(7.8%)	52(57.8%)	59(65.6%)
	No	89(98.9%)	83(92.2%)	38(42.2%)	31(34.4%)

Discussion

The most evident MRI finding in our study was the presence of compromised neural foramina (100%) and compressed nerve root (98.9%), at L4-L5 spinal level in patients with lower backache, whereas L2-L3 was the most spared part [21]. Level L3-L4 exhibited mild to moderate channel stenosis and disc bulge signs, while L5-S1 was found to be strongly affected by disk bulge. Due to compromised neural foramina and compressed nerve root, mild to moderate spinal canal stenosis was also observed in 94.4% of patients. A study by SY Kim suggested that people with acute severe axial low back pain have 87% chances of disc herniation. In the study by 75% of patients were having Facet Joint Arthropathy (FJA), and 72.2% had Nerve Root Compression (NRC) and these findings were common at L4-L5 level in Chronic Low Backache (CLBA) [22]. Another study supported that the most obvious Magnetic Resonance Imaging (MRI) findings of disc herniation were at L4-L5 and L5-S1 levels. These findings are consistent with another study that showed the evidence of the smallest spinal canal at L5-S1 widest at L1-L2.

In this study, the average age of patients with complaints of low back pain was around 45 years (mean age 44.64 years). A study conducted and also showed an average age of 41 years of patients with chronic lower backache, also proved the MRI changes more prevalent at 50 years of age or younger [23]. We have found that disc desiccation or disc osteophyte complexes were the most common pathologies, and also showed the disc desiccation as the most common disc problem, whereas another study supported the existence of disc extrusion as a most common finding. The amazing observation in this study was that disc bulge at L4-L5 and L5-S1 had a great relationship with lower back problems. This kind of relationship has been discussed in a previous study. The lumbar spine radiculopathy has also appeared as one of the major causes of LBP, however, lumbosacral spine pathologies can also frequently mimic the clinical signs and symptoms of radiating pain in lower limbs, and so for ruling that out Magnetic Resonance Neurography (MRN) of lumbosacral plexus is a beneficial tool for the evaluation. The positive neurological assessment can predict nerve root compression in MRI; whereas, such physical examination findings do not predict abnormal Nerve Conduction Studies (NCS) [24].

The major limitation of this study was the small sample size, few variables like pain scale, depression, level of disability, and MRI effects on treatment options were not considered, which have a great impact on the existence of lower back issues. Likewise, there was a study that tried to find out the correlation between MRI findings with the degree of disability

or the intensity of Low Back Pain (LBP). However, a study conducted in 2012 concluded that magnetic resonance imaging does not improve outcomes in patients who are clinical candidates for Epidural Steroid Injections (ESI). So, MRI might have less impact on treatment outcomes. The advantage of this study was that it found the most affected site, the most common cause, and highly reported symptoms in LBP. It had shown the significance of the MRI lumbar spine in patients with chronic lower backache and their clinical evidence of radiculopathy with localized low backache.

Conclusion

In conclusion, our study illustrated that the frequency of low back pain is much higher in both genders, 58.9% males, and 41.1% females, and the most common symptom is bilateral lumbar radiculopathy. Disc desiccation is frequent in patients with lower back pain. The most common targeted sites are L4-L5 and L5-S1 due to the nerve root and foraminal canal compressions and spinal canal stenosis. This study highlights the importance of early MRI in patients with low back pain despite being expensive because it can provide better nerve and disc visualization than conventional x-rays. Further study is needed to evaluate the severity of pain or disability caused by backache that can aid in patient management in timely manner.

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*Correspondence to

Dr. Madih Ariff

Department of Physical Therapy

University of Management and Technology

Lahore, Pakistan

E-mail: madiha.ariff@live.com