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ROLE OF MAGNETIC RESONANCE IMAGING IN PATIENTS WITH LOW BACK PAIN AT A TERTIARY CARE CENTER

Radiology

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ABSTRACT

Background: Low back ache is one of the common indications for MRI in our clinical practice. It is estimated that 70-80% of adults experience low backache at some time during their lives. **Aim:** To study the role of magnetic resonance imaging in patients with low back pain at a tertiary care center and its clinico- radiological correlation with modified oswestry disability index. **Method:** 100 patient between age group 30-70years coming to radiology department with chief complaint of low back pain were included in study. MRI was performed on a GE 0.2 T and Philips 1.5 T MRI Scanner using spine array coils. Abnormal findings will be noted in detail and a MRI diagnosis will be made based on these in each case. The disability was assessed by Modified Oswestry score and correlated. **Result:** Regarding lumbar degenerative disease, a total of 71 cases were analyzed. The most common degenerative finding was disc displacement, accounting for 59% of cases, followed by joint and ligament changes (19%) and end plate changes (17%). The study examined disc herniation at various lumbar levels, finding the highest incidence at L4-L5 (49.1%), followed by L3-L4 (27.9%) and L5-S1 (22.0%). Posterolateral disc bulge was the most common location (62.8%), with central (30.9%) and foraminal (6.3%) following. The distribution pattern based on Oswestry score revealed that 26 patients scored between 0-10, 12 patients between 20-30, 16 patients between 30-40, and 2 patients between 40-50. **Conclusion:** Study underscores the imperative need for advanced and nuanced diagnostic modalities to enable early detection of diseases, thereby minimizing the impact on productive working hours. Imaging studies, especially MRI, play a pivotal role in providing treatment-oriented anatomical information for precise disease localization without intruding or associated risks.

KEYWORDS

MRI, Low back pain, Oswestry score

INTRODUCTION:

Globally, LBP has been shown to cause more years lived with disability (YLD) than any other condition and is considered as one of the leading causes of disability adjusted life years (DALYs) among the general population[1]. In India, a high incidence of LBP has been found in individuals who are involved in jobs that require handling heavy loads, constant sitting/standing position or working at improper body position and prolonged working hours. In fact, the causative factors for LBP are very wide and ranges from body habits, work atmosphere, age and gender[2]. Common causes for low back pain are: Degenerative disc disease, Herniated disc disease, Osteoarthritis, Spondylitis and spondylolysthesis, Spinal canal stenosis and scoliosis and kyphosis[3]. Early diagnosis is often challenging because the initial signs and symptoms are frequently subtle. Given that the preferred treatment strategy is urgent surgical decompression of the spinal canal, imaging is a cornerstone in the workup of these patients. Frequent causes of cauda equina syndrome include disc herniation, trauma, and/ or vertebral metastasis with secondary spinal stenosis and compression of the cauda equina. MRI is regarded as the modality of choice owing to the diversity of potential causes of compression, and difficulty ascertaining the thoraco-lumbar level of compression[4]. With its high contrast and spatial resolution and lack of ionizing radiation, MRI is the best imaging technique for imaging of the spine[5,6]. MR imaging provides multiplanar reconstruction and high contrast resolution for lesion characterization. MR Imaging shows high sensitivity and specificity in evaluating spinal infections[7,8].MRI is non invasive imaging technique with excellent spatial and contrast resolution. Hence, it has become the investigation of choice in evaluation of patients with low back pain or radicular pain. It has also emerged as an investigation of choice over the other investigations for a herniated disc and become a gold standard to diagnose herniated disc[9]. MRI is also useful in planning surgical management of patients with sciatica attributable to lumbar disc herniation[10]. Hence, MRI is the emerging radiological diagnostic tool in the management of low back pain. With MRI evolving as the modality of choice for evaluating spinal lesions, this study aims to evaluate and categorize the spinal causes for low backache using MRI, an observational cross sectional study and to correlate it with oswestry disability index (ODI).

MATERIALAND METHOD:

A total of 150 patients underwent MR imaging for low back pain in the department of Radio-diagnosis at Hind Institute of Medical Sciences, Mau,Ataria,Sitapur,Uttar Pradesh, during study period from August 2022 to December 2023.

Inclusion Criteria

1. Age 30-70 years

Exclusion Criteria

1. Patients with history of surgical metallic implants, pacemaker placement, aneurysm clipping, prosthetic valve implantation.
2. Patients with history of claustrophobia.
3. Patient<30 and >70years of age.

Method Of Collection Of Data

Consent was taken from each patient who came with low back pain. MRI was performed on a GE 0.2 T and Philips 1.5 T MRI Scanner using spine array coils.

RESULT:

In this study on MR imaging for low back pain, the gender distribution showed a slight male preponderance, with 54% males and 46% females. In terms of residence, 41% of patients were from urban areas, while 59% were from rural areas.

In the study, 9 cases were identified as having an infective etiology, all of which were diagnosed with spondylodiscitis. MRI confirmed the diagnosis of infective spondylitis with a strong likelihood of tubercular origin in these cases. Additionally, 8 patients in the study experienced low back pain due to trauma.

Regarding lumbar degenerative disease, a total of 71 cases were analyzed. The most common degenerative finding was disc displacement, accounting for 59% of cases, followed by joint and ligament changes (19%) and end plate changes (17%). Vertebral changes were the least prevalent, observed in 11% of cases.

Anatomical distribution analysis of single-level disc disease revealed that the highest percentage of changes (22%) occurred at the L4-L5 level. In contrast, multiple discs disease was noted in 56% of patients, with various levels of involvement as detailed in the provided table1.

Table1:showing Anatomical Distribution Of Multiple Discs Disease

MRI LEVELS	No of Subjects	Percentage(%)
L3-L4+L4-L5	1	01%
L3-L4+L5-S1	2	02%

L4-L5+L5-S1	16	16%
L1-L2+L3-L4+L5-S1	1	01%
L2-L3+L3-L4+L4-L5	12	12%
L2-L3+L3-L4+L5-S1	3	03%
L2-L3+L4-L5+L5-S1	2	02%
L3-L4+L4-L5+L5-S1	10	10%
L1-L2+ L2-L3+L3-L4+L5-S1	2	02%
L1-L2+L3-L4+L4-L5+L5-S1	2	02%
L2-L3+L3-L4+L4-L5+L5-S1	5	05%
TOTAL	56	

The study analyzed the incidence of disc herniation at various lumbar levels, with the most common involvement observed at the L4-L5 level (49.1%), followed by L3-L4 (27.9%) and L5-S1 (22.0%) shown in table2.

Table2:showing Disc Herniation At Various Lumbar Levels

HERNIATION TYPE	L1-L2	L2-L3	L3-L4	L4-L5	L5-S1	No of Subjects	Percentage(%)
Annular Disc Bulge	2	6	17	38	19	82	60.2
Disc Protrusion	1	2	10	26	08	47	34.6
Disc Extrusion	0	0	1	3	2	6	4.4
Disc Sequestration	0	0	0	0	1	01	0.73
Total	03	8	38	67	30	136	100
Percentage(%)	2.1	5.9	27.9	49.1	22.0	100	

Additionally, the prevalence of different positions of herniated discs was examined, with posterolateral disc bulge being the most common location (62.8%), followed by central (30.9%) and foraminal (6.3%).

Furthermore, the distribution pattern based on degenerative end plate disease was investigated, revealing that out of 17 cases observed, 13 belonged to grade II, 4 to grade I, and none to grade III changes. Additionally, spinal canal stenosis was identified in 5% of cases, with 4 showing grade II changes and 1 with grade I changes.

In the study, facet joint arthropathy was identified in 11 cases (11%). Among these cases, 8 exhibited grade I changes, 2 showed grade II changes, and 1 displayed grade III changes. The distribution of facet joint arthropathy across different annulus levels was as follows: L4-L5 had 3 cases with grade I (37.50%), 1 case with grade II (50.00%), and 1 case with grade III (100%); L5-S1 had 1 case with grade I (12.50%) and 1 case with grade II (50.00%). Other annulus levels showed varying percentages of facet joint arthropathy. Regarding ligamentum flavum hypertrophy, 19 cases (19%) were observed in the study, with the highest occurrence at the L4-L5 level. The distribution pattern of ligamentum flavum hypertrophy across different annulus levels showed that L4-L5 had the highest percentage (52.63%), followed by L3-L4,L4-L5 (42.10%).

In terms of the correlation with the modified Oswestry score, the majority of patients had scores ranging from 10 to 20 (44 patients, 44.0%) as shown in table3.

Table3:showing Distribution Pattern Based On Oswestry Score

Oswestry score	Number	Percentage (%)
0-10	26	26.0
10-20	44	44.0
20-30	12	12.0
30-40	16	16.0
40-50	2	2.0

DISCUSSION:

There is need for sensitive and refined modalities of diagnosis for early detection of disease, so as to minimize the loss of productive working hours.The role of imaging studies is to provide treatment oriented anatomical information which helps in disease localization. MRI reliably identifies and localizes the spinal abnormality non-invasively on an outpatient basis, without any risk or morbidity.

These findings are valuable for researchers and healthcare professionals, providing insights into the demographic composition of the patient population under study. Understanding these demographics is crucial for tailoring healthcare strategies and interventions to meet the specific needs of different age groups, genders, and urban or rural residents. In the current study, the majority of patients (46.0%) fall within the 40-59 years age group. Also, 30-39 years age group and the 60-70 years age group both represent a significant portion of the population, with 33.0% and 21.0%, respectively. The age distribution indicates a diverse range of patients, with a significant representation from middle-aged individuals (40-59 years).

Low back pain in the study shows a slight male preponderance, with males constituting 54.0% of the patients which is similar to other study which show that low back pain affects more male because of mechanical injury and stress[11-12] or the variation in gender distribution within our study can likely be attributed to the inclusion of patients undergoing MRI for low back pain. Given that not all individuals experiencing low back pain opt for MRI, this selection criterion may have contributed to a higher proportion of males in our study. On the contrary, Modic MT et al, 2007[13], in there study showed that female sex is more commonly affected than males.

The majority of patients (59.0%) in the present study presenting to the radiology department for MR imaging belong to rural areas. The detailed breakdown of MRI findings among patients with low back pain provides a comprehensive understanding of the varied etiologies. In this study, lumbar degenerative change represents the majority (71%) of cases, highlighting degenerative disc disease as the most common pathology associated with low back pain. Neoplastic lesions were the least common type of lesions causing low back pain in the current study. Like the current study, Battie MC et al., in his study found that 76% of cause for low back ache was degenerative disc disease[14]. Similarly, in other studies it was identified that 74% of cause for LBA was degenerative disc disease[15,16] . Alike our study, Savage et al.[17] conducted a study in 1997 and reported disc degeneration in a little more than half (53%) of the LBP cases.

This study highlights that disc displacement is the most prevalent (59%) degenerative change in the lumbo-sacral spine, followed by joint and ligament changes(19%), end plate changes(17%), and vertebral changes in decreasing order of occurrence. Since lumbar spine is subjected to heavy mechanical stress, it is a common area affected by degenerative changes. The study emphasizes that degenerative disc changes in the lumbar spine often involve multiple levels, with contiguous levels being more prevalent. L4-L5 remains a significant focal point for both single and multiple-level degenerative changes. Multiple contiguous level disc disease was noted in the majority of cases (56%). The most common combination was L4-L5 + L5-S1 (16%), followed by L2-L3 + L3-L4 + L4-L5 (12%). Proportion of degenerated discs progressively increases with lower spine levels, and the most common spine levels involved were L4/L5 and L5/S1[18,19]. This could explain such observation in this study group.

The study highlights a clear predilection for disc herniation at the L4-L5 level (49.8%), followed by L5-S1(21.7%) and L3-L4 levels(21.4%). Various studies have reported that disc herniation is common at L4/L5 and L5/S1 and the frequency at these levels is ranging from 30% to over 90%[19,20,21]. The majority of cases involve Annular Disc Bulge, indicating that this type of bulge is predominant in the lumbar spine. Alike current study it is also similar to the findings reported by Sivas et al[22]., Rama Krishna Narra et al[23]. and other studies[18,24]. This study also emphasizes the predominance of postero-lateral disc bulge in degenerative disc disease, highlighting the importance of assessing and addressing bulge in this specific region. The dominance of postero-lateral disc bulge suggests that the back and sides of the intervertebral discs are particularly susceptible to degenerative changes leading to herniation. This may be influenced by factors such as mechanical stress, age-related degeneration, and anatomical variations. Similar to present study, Knop-Jerges BM et al., in his study stated that most common position of disc herniation was postrolateral, which was about 60%[25]. While in an another study by Gopalakrishnan et al. he observed that paracentral disc herniation was commonest type of disc herniation seen in about 65% of patients followed by central disc herniation (30%) and foraminal disc herniation (5%)[26]

The present study indicates a notable occurrence of degenerative end plate disease, primarily concentrated in Grade II changes. The distribution across lumbar levels suggests that the L4-L5 and L5-S1 levels are particularly affected. The absence of Grade III changes may indicate that severe degenerative alterations to the end plates were not observed in this study population. Similar to current study,Yu et al in their study of end plate changes found type II changes to be commonest followed by type I and lastly type III, which was very rare and was seen

in only one patient[27].

Current study found end plate changes in 28 cases i.e., 16% of the total study population. Largest number was found to have Type II changes (19), Type I (4) and Type III (5) changes were much less common. Like current study, Modic et al[28]. found Type I changes in 4% and Type II changes in 16.0% cases undergoing MR imaging for lumbar disease. They did not specify the prevalence of Type III end plate changes in their study subjects.

In this study, 5% cases showed spinal canal stenosis. Degenerative lumbar spinal stenosis is caused by decreased space for neural and vascular elements in the lumbar canal secondary to degenerative arthritic lumbar changes[29]. Spinal stenosis can occur as a congenital-developmental problem with diminutive caliber of the spinal canal but is usually an acquired condition due to disk bulges, herniations, facet hypertrophy, and ligamentum flavum redundancy.

Similar to the previous discussion on degenerative end plate disease in the present study, facet joint arthropathy also shows a predilection for the L4-L5 level, which is a common site for degenerative changes in the lumbar spine. Grade I is the most common, followed by Grade II, and there was one case with Grade III changes. Grade I Arthropathy, typically represents mild degeneration of the facet joints, which may cause localized pain and stiffness and Grade II Arthropathy, indicates moderate degeneration and may lead to increased pain, limited range of motion, and potential inflammation. Weishaupt et al[30]. studied asymptomatic subjects for degenerative changes in the spine and reported prevalence of mild to moderate facet joint osteoarthritis, of 18% and 22% by two separate readers.

Similar to current study, a study by Smith et al. found that patients with more severe disc degeneration on MRI had higher Modified Oswestry Scores, indicating greater functional impairment[31]. Similarly, other studies have shown a correlation between the presence of herniated discs, spinal stenosis, or nerve root compression on MRI and higher Modified Oswestry Scores.

CONCLUSION:

The demographic insights gained from this study are crucial for tailoring healthcare strategies to cater to the diverse needs of different age groups, genders, and residents of urban or rural areas. MRI is a crucial tool in evaluating low back pain at tertiary care centers, offering detailed spine images for precise diagnosis. The correlation between MRI findings and the Modified Oswestry Score enhances diagnostic accuracy, understanding functional limitations and disability comprehensively. Despite limitations, MRI significantly aids in diagnosing and treating low back pain.

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