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Study to Evaluate the MRI Findings and Their Association to Clinical Features in Young Adult Patients With Low Back Pain Attending the Tertiary Care Center South India

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ABSTRACT

The purpose of this study was to determine the MRI findings and their correlation to the clinical features in young adult patients with low back pain. The study was conducted in the department of radiology. The hospital offers both outpatient and in-patient services. It has a radiology department equipped with 1.5 Tesla MRI, computed tomography (CT). 200 patients were included in the study. Of 200 patients, 110 were male and 90 female. The patients included in the study were 18-39 years old, with a median age (IQR) of 32 [14-23]. The majority of patients aged 28-32. Fifty percent worked professionally. There were 112 (56%) patients who experienced pain gradually and 88 (44%) who experienced it quickly. Most of the severe pain (148, 74%) described by 166 (82%) patients was burning. The study indicated that 62% of patients had radiating symptoms, which were worsened by bending down (n = 86, 43%) and relieved by reclined (n = 180, 90%). The median pain duration was 4 weeks, ranging from 1 to 14 weeks. Nerve root compression occurred in 55% of cases. Most nerve root compromises occurred at the L4-L5 level (28%), followed by L5-S1 (25%), and L3-L4 (8%). Grade 3 nerve root compression was the most common, at 122% (61). The most prevalent clinical manifestation among people with LBP is pain that persists for a duration beyond 10 weeks. In this study, the most often observed results in individuals with acute onset severe low back pain (LBP) include irregularities in the shape of the disc, desiccation of the disc, and a decrease in disc height. The most prevalent observation in this study is the presence of radiating low back pain (LBP) in patients with disc protrusion.

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INTRODUCTION

Based on data from the National Center for Health Statistics, impairments of the back and spine are identified as a prominent factor contributing to the restriction of physical activity among those under the age of 45. Low back pain (LBP) is a prevalent complaint worldwide and in our country, primarily caused by degenerative spinal disorders[1-3]. In the majority of developed nations, low back pain (LBP) caused by degenerative spine diseases is the leading cause of physical disability across all age groups, particularly among individuals in their fourth decade and older. It is also the second most prevalent reason for seeking medical consultation[4-6]. The development of lumbar spine degenerative illnesses has been influenced by specific lifetime occupations and activities[7]. Activities that fall under this category encompass heavy weight lifting or any task that necessitates excessive bending of the waist[8]. Takatala *et al*. conducted a study on Finnish young adults with low back pain using MRI. The study revealed that sportsmen commonly experienced disc degeneration (Modic alterations, Schmorl's nodes), disc bulging, radial rips, spondylosis and sacroiliac joint abnormalities. Women had a higher prevalence of high intensity zone lesions, whereas men had a higher prevalence of disc herniating. Disc extrusion was the least common in both genders. Delayed disc findings are frequently observed at the L5-S1 level, whereas lesions in the high intensity zone are predominantly observed at the L4-L5 level[9]. The objective of this study was to ascertain the magnetic resonance imaging (MRI) results and their association with clinical characteristics in a cohort of young adult individuals with low back pain.

MATERIALS AND METHODS

Hospital based observational study which was carried out in the radiology department, over a period of one year. The hospital provides a range of services, including both outpatient and inpatient care. The institution possesses a radiology department that is furnished with a 1.5 Tesla MRI and computed tomography (CT). The study comprised a total of 200 patients. The study involves a sequential selection of young adults, aged 18 to 39, who have been referred to the department and are scheduled to have MRI lumbosacral spine examination.

Data Collection: The recruitment of participants took place at the receiving station of the MRI room and signed informed consent was collected. The researchers collected and documented bio-data, clinical details and the level of physical activity. A 1.5 Tesla MRI machine (Siemens Medical Systems, model-Espree, Town-Henkestr, County-Erlangen) was utilized to conduct an MRI scan of the lumbar spine. The scan employed a dedicated receive-only spine coil and followed a standard protocol specification for young adults in sagittal T1W, T2W, T2W STIR, T2W myelo sequences. Coronal and axial reformats were acquired at levels T12-S1. The images were obtained using T1WI with Contrast and gradient echo (GRE) sequences in cases where there were suspicions of neoplastic and inflammatory conditions. The MRI pictures were observed using the picture archiving and communication system (PACS). The lead investigator prepared the radiological reports, which were then reviewed by two consultant radiologists who have extensive expertise in neuroradiology imaging. All divergent viewpoints were resolved through consensus. Data was collected for each image using a de-identified data collecting form, which was designed to eliminate any unique identifiers that could potentially identify the image's identity. The correctness, completeness and consistency of all study data forms were frequently assessed and any errors that were detected were promptly rectified. The completed data from all forms was organized and assigned unique research identifiers.

Data Analysis: Frequency and proportions of variable were determined using descriptive statistics. Continuous variables were summarized in median and inter quartile range. Median and interquartile ranges were used because the data were not normally distributed. Variables with $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS

Of the 200 patients (110 males and 90 females; age range 18 to 39 years with median [IQR] 32 [14-23]. Most of the patients belonged to 28-32 years. 50% were professionally employed. 112 (56%) patients had gradual onset of pain whereas 88 (44%) had sudden onset, 166 (82%) patients had severe pain and most of which were burning in nature (n = 148, 74%). Majority of the patients had radiating pains (n = 124, 62%) that was frequently aggravated by bending down (n = 86, 43%) and alleviated by lying down (n = 180, 90%). The median duration of pain was 4 weeks, with a minimum duration of 1 week and maximum of 14 weeks. Nerve root compression was observed in 55% of the total cases. Nerve root compromise was also noted most frequently at L4-L5 level (28% of cases), followed by L5-S1 (25%) and L3-L4 (8%) levels in decreasing order of frequency. Grade 3 nerve root compression was the most common and was observed in 122% (61) of cases with nerve root compression.

Acute lower back pain is a prevalent cause for hospital admissions. Around 33% of adults encounter lower back pain at some point in their lives[10], while the lifetime occurrence of lower back pain is estimated to be between 70% and 85%[11]. Although lower back pain is quite prevalent, precisely diagnosing its cause is

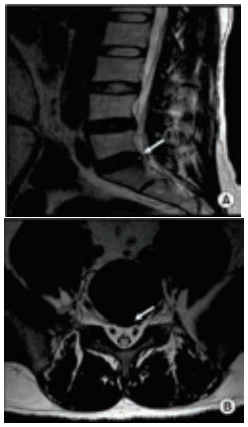

Fig 1: Magnetic resonance images of high intensity zone (HIZ), (A) The sagittal T2-weighted magnetic resonance image showing a HIZ (arrow) within the posterior annulus at L5-S1, (B) Thaxial T2-weighted magnetic resonance image shows a HIZ (arrow) within the posterior annulus at L5-S1

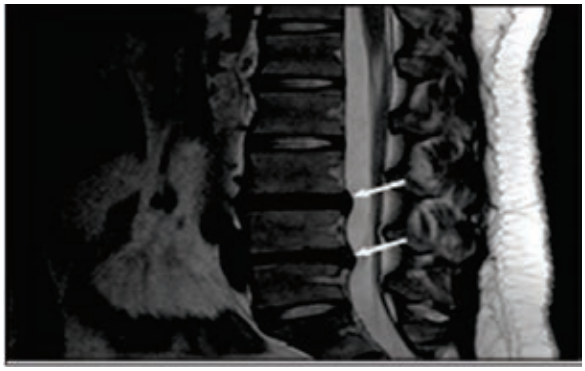

Fig 2: Magnetic resonance images of lumbar disc degeneration (LDD). The sagittal T2-weighted magnetic resonance image at L3-L4 and L4-L5 levels shows a degenerative signal loss with mild height reduction

Table 1: Socio-demographic profiles of the patients

Variable	no. of percentage
Sex	
Male	110 (55)
Female	90 (45)
Age, median (IQR)	32 (29-38)
18-22	20 (10)
23-27	28 (14)
28-32	56 (28)
33-37	44 (22)
38-42	52 (26)
Occupation	
Housewife	20 (10)
Students	28 (14)
Business	48 (24)
Professional (formally employed)	100 (50)

Table 2: Pain characteristics of the study participants

Variable	no. of percentage
Duration of pain	
≤6 weeks	100 (50)
>6-11 weeks	32 (16)
>12 weeks	68 (34)
Onset of pain	
Gradual	112 (56)
Sudden	88 (44)
Side of the back affected	
Left	20 (10)
Right	40 (20)
Both	140 (70)
Quality of pain	
Aching	52 (26)
Burning	148 (74)
Severity of pain	
Mild	0
Moderate	36 (18)
Severe	166 (82)
Aggravating factors	
Bending	86 (43)
Sitting	160 (40)
Standing	34 (17)
Alleviating factors	
Walking	10 (5)
Sitting	10 (5)
Lying down	180 (90)
Distribution	
Localised	76 (38)
Radiating	124 (62)

Table 3: Grades of nerve root compression at different level among the study participants

Compressed nerve	Grade 1	Grade 2	Grade 3
L2	0	0	6
L3	4	6	8
L4	4	10	16
L5	4	20	50
S1	10	20	42

challenging and its treatment is expensive and leads to significant work day absences. In the majority of instances, the aetiology of lower back pain, in the absence of any indicative symptoms, is attributed to a self-manageable ailment and is recognized as a benign condition. Red-flag indicators encompass severe neurological abnormalities or organic ailments such as tumors, infections, paralytic syndrome, or fractures, need prompt evaluation and intervention[12]. The utilization of diagnostic imaging can significantly influence the accurate diagnosis of lower back pain and the subsequent treatment options by offering precise anatomical data from a therapeutic perspective. Magnetic resonance imaging (MRI) allows for the observation of exceptional vertebral abnormalities that were previously undetectable[13,14].

Out of the 200 patients, there were 110 males and 90 females. The age range of the patients was 18 to 39 years, with a median age (IQR) of 32[14-22]. The majority of the patients are between the ages of 28 and 32. Fifty percent of the individuals were engaged in professional employment. Out of the total number of patients, 112 (56%) experienced discomfort gradually, whereas 88 (44%) had pain suddenly. Additionally, 166 (82%) patients reported severe pain, with the majority of it being searing in nature (n = 148, 74%). The study found that a significant proportion of the patients experienced radiating symptoms (n = 124, 62%), which

were often exacerbated by bending down (n = 86, 43%) and eased by reclining down (n = 180, 90%). The pain had a median duration of 4 weeks, ranging from 1 week to 14 weeks. The findings of our study align with previous research undertaken in other global areas, focusing on comparable age cohorts[15]. The majority of patients in this study exhibited several levels of illness, with the largest occurrence (46%) observed at the two lowest lumbar levels (L4/L5 and L5/S1), which aligns with previous findings[15,16-7]. Takatalo *et al*. conducted a study in Finland with individuals aged 20-22 years. The study revealed a prevalence rate of 47% for degenerative illnesses affecting the lumbar spine[16]. In a study conducted by Al-Saeed *et al*.[15]. in Kuwait, a comparison was made between the MRI features of cases and control groups aged 16-29 years. The findings revealed that 64% of the cases had signs of disc degeneration.

Reports indicate that a lack of physical activity (sedentary lifestyle) is linked to a higher occurrence of disc degeneration and a greater prevalence of low back pain in young adults[18]. Additionally, there are studies that indicate a correlation between engaging in high-intensity activities, such as competitive sports, and a higher frequency of MRI findings indicating disc abnormalities in young adults[19]. Excessive labour has also been identified as a contributing factor to the development of disc degeneration[20]. In the current investigation, a majority of the patients, specifically 75%, indicated engagement in moderate to severe activities, with a significant proportion being male. Several studies have reported a correlation between elevated environmental temperatures, particularly in tropical regions and the occurrence of disc desiccation[9].

The statistical analysis conducted in our study provides confirmation that age, pain distribution and duration of pain are independent characteristics that are linked with aberrant MRI findings. This is corroborated by a comprehensive study conducted in Norway[20], the Middle East[15] and China[21], which demonstrated a significant occurrence of MRI results linked to a past of persistent pain in the lumber-sacral area. Research indicates that the persistent clinical characteristics of LBP are linked to the majority of abnormalities shown on MRI. This fact is further corroborated by the present investigation, which revealed that patients with a documented history of chronic back pain exhibited magnetic resonance imaging (MRI) characteristics indicative of disc degenerative disease. Compression of the nerve root was detected in 55% of all instances. The most commonly observed nerve root compromise was observed at the L4-L5 level in 28% of cases, followed by L5-S1 at 25% and L3-L4 at 8%, in descending order of frequency. The prevalence of Grade 3 nerve root compression was found to be the highest, accounting for 122% (61) of reported cases of nerve root compression. Nerve root compression was reported in 55% of all instances in this investigation. Out of the examined cases, 70% (79) had central canal stenosis, while 35.4% (40) had neural foraminal constriction. In a study conducted by Yong *et al*.[22]. a total of 56 Japanese patients were examined. The researchers observed spinal stenosis in 34 patients (59.6%) and foramina constriction in 17 individuals (29.8%). Disc degeneration findings are frequently construed as etiological factors for back pain, prompting the implementation of medicinal and surgical procedures, which can prove ineffective in mitigating the patient's symptoms[23].

CONCLUSION

The most prevalent clinical manifestation among people with LBP is pain that persists for a duration beyond 10 weeks. In this study, the most often observed results in individuals with acute onset severe low back pain (LBP) include irregularities in the shape of the disc, desiccation of the disc and a decrease in disc height. The most prevalent observation in this study is the presence of radiating low back pain (LBP) in patients with disc protrusion. This study presents a range of MRI findings in patients suffering from the condition of low back pain. Disc protrusion is predominantly observed at the L4-L5 level and there is grade 3 nerve root compression which was also very common.

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