Section: Radiodiagnosis

Original Research Article

STUDY ON ROLE OF MAGNETIC RESONANCE IMAGING IN EVALUATION OF LOW BACK PAIN OF NON-TRAUMATIC CAUSES IN A TERTIARY CARE HOSPITAL

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Received *: 15/04/2025*
Received in revised form *: 25/05/2025*
Accepted *: 02/06/2025*

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DOI: 10.70034/ijmedph.2025.2.408

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (2); 2260-2264

ABSTRACT

Background: Two-thirds of adults experience low back pain at some point in their life, making it a widespread issue.Low back pain can have a variety of causes, such as anomalies of the lumbosacral spine or issues with the soft tissue that surrounds it.Most significantly, radiological imaging influences the treatment decision-making process and aids in the establishment or exclusion of pathological diseases.

Materials and Methods: 85 consecutive patients who underwent MR and X-ray imaging at Kanti Devi Medical College and Research for non-traumatic causes of low back pain were included in the prospective cross-sectional study, which had a 95% confidence interval and a 5% alpha error based on the literature currently in publication.

Results: The study's age range was 21–65 years old. The participants in the study had an average age of 41.32 years. 1.26:1 was the male to female ratio (M=48, F=37). Low back pain is the most prevalent symptom, accounting for 70 (82.35%).

Conclusion: The age range of 21 to 50 is the most frequently impacted by low back pain.When it comes to identifying significant spine diseases such osteomyelitis and primary or secondary neoplasms, plain radiography has a low sensitivity.When low back discomfort is present, magnetic resonance imaging is a non-invasive, extremely sensitive way to assess the spine.

Keywords: Magnetic resonance imaging, lumbar spine, low back pain, and non-traumatic reasons.

INTRODUCTION

Two-thirds of adults will experience low back discomfort at some point in their lives.One of the most frequent patient symptoms in clinical practice is low backache, often known as lumbago, which has serious financial repercussions.Anomalies of the lumbosacral spine or those involving the soft tissue around the lumbosacral spine are among the various causes of lumbago.[1] Athletes, software professionals, industrial workers, clerks, and daily laborers are most susceptible to the illness.Back pain or radicular pain syndrome are two possible presentations for the afflicted patients.[2] In addition to direct biochemical and inflammatory reasons, disc herniation can mechanically compress neuronal components, which can result in pain.[3] Depending on where they are located, spinal tumors can cause a variety of symptoms, including low back pain.[4] Age-related degenerative processes in the facet joints and intervertebral disks, as well as trauma to the muscles and ligaments, are the primary culprits. Disc herniation and spinal stenosis are two more. In the absence of trauma, low back pain with a musculoskeletal cause is recognized to frequently arise from lumbar spine degenerative illnesses. Radicular discomfort can result from bulging discs that impinge on nerve roots, and disc degeneration is a natural aspect of aging. MRI, computed tomography (CT), and plain radiography are the

three main imaging modalities.MRI is the ideal imaging method for imaging the spine because of its excellent contrast, spatial resolution, and lack of ionizing radiation. For lesion characterization, MR imaging offers high contrast resolution and multiplanar reconstruction.In addition to displaying anatomic information not possible with isotope investigations, unenhanced and contrast-enhanced MR imaging can show inflammatory, neoplastic, and most traumatic lesions.When assessing spinal infections, MR imaging exhibits great sensitivity and specificity. This study attempts to assess and classify the non-traumatic spinal causes of low backache using MRI, an observational cross-sectional study, since MRI is becoming the preferred modality for evaluating spine abnormalities. The lumbar spine in numerous planes, extradural soft tissues (such as intervertebral discs), paravertebral muscles, exiting nerve roots, and intradural structures (such as the spinal cord, conus medullaris, and intrathecal roots) are all frequently seen on magnetic resonance imaging (MRI). When compared to CT, with or without intrathecal contrast agents or myelography, MRI offers more comprehensive information about all of these.[5]

MATERIALS AND METHODS

The study included 85 consecutive patients who, between December 2023 and November 2024, had MR and X-ray imaging for nontraumatic causes of low backache at the Department of Radiodiagnosis, Kanti Devi Medical College and Research, Centre Mathura.

Inclusion Criteria

During the study period, all non-traumatic patients of low back pain (ages 21 to 65) were referred to the Radiology Department of Kanti Devi Medical College and Research Center for MR imaging.

Exclusion Criteria

Casesof low back pain caused by trauma pregnant women and postoperative lumbosacral spine patients.

Data collection: Every patient gave their informed permission. The patients' demographic information and comprehensive medical history were obtained.Type of disc involvement, location of disc involvement, disc herniation features, canal stenosis, neural foraminal constriction, ligamentum flavum hypertrophy, facetal hypertrophy, end plate changes, and paraspinal soft tissue abnormalities are among the MRI imaging findings that were assessed.Intervertebral disc height reduction, spondylosis, spondylolisthesis, sacralization, and facial arthrosis are among the X-ray results that were assessed.Each patient's X-ray and MRI results were compared.

Statistical Analysis: Prevalence data from the literature was used to determine the sample size, which had a 95% confidence interval and a 5% alpha error. Version 20 of the SPSS software was used to do the statistical analysis.

RESULTS

The age group included in the study was 21-65 years. The mean age of the patients included in the study was 41.32 years. The male to female ratio was 1.26:1 (M=48, F=37). Most common symptom is low back pain 70(82.35%). Most common region involved is L4-L5 region 68(80.0%). The commonest levels involved in multiple disc abnormalities were L4- L5+L5-S1 (22.72%) followed by L3-L4+L4-L5+L5-S1 (16.66%). Single discs involved in 19 cases (22.35%), multiple discs involved in 66 cases (77.64%). The commonest disc herniation characteristic was diffuse disc bulge (75.29%) and disc protrusion (38.82%).

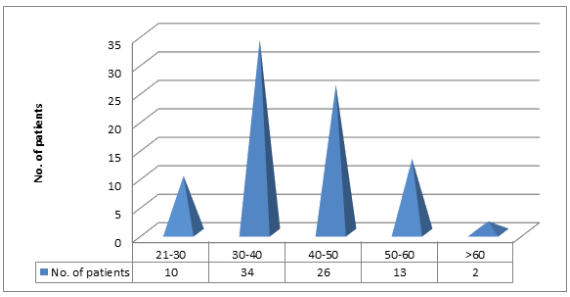

Figure 1: Shows the distribution of the patient's a/c to age group.

Table 1: Shows the anatomic distribution of single disc degenerative disease.

MRI Levels	Single disc abnormalities (%)(n=19)
L1-L2	00 (0.0%)
L2-L3	00 (0.0%)
L3-L4	03 (15.78%)
L4-L5	10 (52.63%)
L5-S1	06 (31.57%)

Table2: Shows the anatomic distribution of multiple disc degenerative disease.

MRI Levels	Multiple disc abnormalities (%) (n=66)
L3-L4+L4-L5	4 (6.06%)
L3-L4+L5-S1	5 (7.57%)
L4-L5+L5-S1	15 (22.72%)
L1-L2+L3-L4+L5-S1	2 (3.03%)
L1-L2+L4-L5+L5-S1	2 (3.03%)
L2-L3+L3-L4+L4-L5	9 (13.63%)

L2-L3+L3-L4+L5-S1	5 (7.57%)
L2-L3+L4-L5+L5-S1	4 (6.06%)
L3-L4+L4-L5+L5-S1	11 (16.66%)
L1-L2+ L2-L3+L3-L4+L4-L5	1 (1.51%)
L1-L2+L3-L4+L4-L5+L5-S1	2 (3.03%)
L1-L2+ L2-L3+L3-L4+L5-S1	2 (3.03%)
L2-L3+L3-L4+L4-L5+L5-S1	4 (6.06%)

Table 3: Shows the MRI Diagnosis of Various Causes of Low Back Pain

MRI Diagnosis	No. of patients (%)
Degenerative Changes	68 (80.0%)
Infective	15 (17.64%)
Inflammatory	4 (4.70%)
Neoplastic	9 (10.58%)
Congenital	3 (3.52%)
Arachnoid cyst	1 (1.17%)

DISCUSSION

For the trial, a total of 85 participants were enrolled. The study group's average age ranged from 21 to 60 years old. Of the 83 patients, 97.64% were between the ages of 21 and 60. Given that the patients in this category are in the economically productive age range, this is a noteworthy and concerning discovery. Although other variables, such as repeated traumatic injuries and physical loading, might contribute to disk degeneration, the incidence of disk degeneration in young people (ages 21 to 40) is likely due to hereditary susceptibility. In order to reduce the loss of productive working hours, this highlights the necessity of sensitive and sophisticated diagnostic techniques for early disease identification.

Of the 168 cases examined, 91 (54%) had plain radiographs that were normal upon MRI assessment.In 77 of these cases, disc degeneration was discovered (46%).Thus, it is clear that early disc degeneration cannot be detected or predicted with high sensitivity using plain radiographs.Pajanen et al. reported similar results.[6]

In our investigation, disc degeneration was consistently linked to narrowed disc space.Likewise, disc degeneration was almost always linked to end plate sclerosis.In three cases, bone erosion was seen.Later, it was discovered that two of them were tubercular spinal osteomyelitis and the third was a malignant disease.

MRI revealed the presence of bone canal stenosis, which was observed in certain patients.No higher incidence of disc degradation was linked to transitional vertebrae, spondylolisthesis, or scoliosis.Other authors have reported findings that are comparable to ours.

The majority of these degenerative abnormalities (60.4%) were observed at L4/L5 and L5-S1.The exact etiology of a degenerative disc change is unknown, although it starts early in life and is partially a result of aging.Numerous factors, including genetic, pharmacological, and immunological ones, have been linked to hastening the process.The lumbar spine is frequently impacted by degenerative changes because it experiences a lot of mechanical stress.Such observations in this study group may be explained by this. L4/L5 and L5/S17 were the most frequently affected spine levels, and the proportion of degenerative discs gradually rises with decreasing spine levels.[7,8] This is comparable to the findings of this investigation.

In 60 cases, at least one lumbar disc was discovered to be deteriorated, and in 25 cases, the disc height was found to be decreased.L5-S1 was the most prevalent level of disc degeneration, followed by L4-L5.All instances with narrowed disc gaps on X-rays displayed disc degeneration at the appropriate levels when compared to the results of plain radiographs.Therefore, disc degeneration at the same levels on MRI and narrowed disc space and end plate alterations on conventional radiographs were found to be strongly correlated. Our results are consistent with a 1989 study by Pajanen et al,[6] that compared disc degeneration on MRI with roentgen ogram findings in patients with low back pain.They stated that L5-S1 and L4-L5 were the most prevalent disc degeneration levels.In their investigation, disc degeneration on MRI was linked to every patient with a narrowed disc space on radiography.In their investigation, they made no mention of the relationship between disc degeneration on MRI and changes in end plate degeneration.

Another common finding in degenerative diseases of the lumbar spine is disc displacement.A simple bulging or herniation may be the cause of the misplaced disc.Protrusion, extrusion, or sequestration are the three types of herniated discs.Disc bulging was more prevalent in this investigation, which is consistent with the results published by Sivas et al.[7-10]Just 20% of ruptured discs were extrusions, while the majority (80%) were protrusions.According to several studies, disc herniation is frequent at L4/L5 and L5/S1, with a frequency that ranges from 30% to over 90% at these levels.[11,12] 61% of the ruptured discs in this study were located in L4/L5 and L5/S1, which further supported this finding. This can be the result of tension at these lower lumbar levels of the spine brought on by the heavy workload.

29 patients (20%) in our study had facet joint arthropathy.Of them, four had grade I changes,

eighteen had grade II changes, and seven had grade III changes.75 study populations had degenerative alterations in their facet joints, according to Savage et al.[13] According to two different reviewers, the prevalence of mild to moderate facet joint osteoarthritis was 18% and 22%, respectively, in Weishaupt et al.'s study of asymptomatic participants for degenerative alterations in the spine.[14] Nevertheless, neither reader discovered any serious osteoarthritis in their individuals.As a result, they proposed that low back pain might be actively caused by severe osteoarthritis of the facet joints.

We discovered end plate alterations in 25 cases, or 14.88% of the research population.Type II modifications were found to be the most prevalent (18), while Type I (3) and Type III (4) changes were significantly less frequent.When undertaking MR imaging for lumbar disease, Modic et al,[15] discovered Type I changes in 4% of cases and Type II changes in 16.0%.The frequency of Type III end plate alterations in their research participants was not specified. We discovered end plate alterations in 25 cases, or 14.88% of the research population. Type II modifications were found to be the most prevalent (18), while Type I (3) and Type III (4) changes were significantly less frequent. When undertaking MR imaging for lumbar disease, Modic et al,[15] discovered Type I changes in 4% of cases and Type II changes in 16.0%. The frequency of Type III end plate alterations in their research participants was not specified.

38 cases of spinal stenosis (a prevalence of 22.61%) were identified in our investigation.Lumbar canal stenosis was suspected in two cases after plain radiographs showed a decreased sagittal lumbar canal diameter.Two cases of stenosis with congenitally short pedicles were confirmed on MRI, and a third instance of bone canal stenosis was found.Furthermore, in 19 of these instances with degenerative alterations and 3 with bone canal constriction, MRI showed soft tissue canal stenosis.The majority of the cases combined ligamentum flavum enlargement, facet hypertrophy, and disc herniation.Spondylolisthesis was observed in two of the patients.

Three instances in our investigation were determined to have an infectious origin.(Spondylodiscitis was seen in every patient).In these instances, an MRI revealed a strong probability of tubercular origin and a conclusive diagnosis of infective spondylitis.All eight instances had contrast-enhanced CT, and one case that needed confirmation underwent CT-guided fine needle aspiration cytology (FNAC). With a mean age of 32 years and all cases under 50, the cases belonged to a comparatively younger age group.Both patients had complained of low back pain that had started slowly and persisted for more than two months.Two of the individuals reported less appetite, but none of them suffered fever or weight loss.Three out of the eight instances showed local discomfort, four showed positive straight leg raising, five showed paraspinal muscular spasm, and seven showed restricted lumbar movement.A slow ankle jerk was discovered in one case, but no neurological abnormality was present in any of the others. ESR was slightly raised in one case and significantly elevated in another during regular checks.Both cases' chest radiographs came out normal.While the patients were on ATT, it was shown that MRI results and clinical response to treatment were well correlated.When the right treatment was administered, the MR images showed that the vertebral bodies and IV discs had returned to their normal signal intensity (SI), despite sclerotic alterations and marrow replacement by fat.

According to Modic et al.'s publication,[15] our findings indicated that MRI appearances of vertebral osteomyelitis are distinctive. Reliable criteria for diagnosing vertebral osteomyelitis included a confluence of decreased signal intensity from the vertebral bodies and intervertebral discs, with an inability to distinguish a margin between the disc and adjacent vertebral body on T1 weighted images, and increased signal intensity of the vertebral bodies and discs on T2 weighted images.

Furthermore, we discovered that large paravertebral soft tissue collections, skip lesions, and multiple segment involvement were all accurate indicators of tubercular etiology. For example, we discovered that four cases treated empirically with ATT without a tissue diagnosis demonstrated a significant improvement in both clinical and imaging outcomes over a period of three to six months, confirming the MRI-suggested diagnosis of tubercular spondylitis. In his publications, Sharif detailed similar observations.[16]

On MRI, an intradural extramedullary lesion was discovered in one instance.Nerve sheath tumors were the tentative diagnosis.The lesions were surgically removed from the patient.The results of the histopathological analysis showed neurofibroma.It has been reported that between 80% and 90% of all intradural extramedullary neoplasms are nerve sheath tumors or meningiomas.Ganglioneuromas are comparatively uncommon among nerve sheath tumors, but schwannomas are more prevalent than neurofibromas.Adults in their middle years typically exhibit these.Neurofibromatosis frequently manifests as several lesions.These tumors can mimic herniation and can cause low back pain.[17] A 40-year-old woman with low back discomfort was found to have an intramedullary lesion of the conus medullaris.The basic investigations, including plain radiography, were normal.With a central lesion that was isointense on T1W1 and hyperintense on T2W1, the MRI showed a wider conus.Myxopapillary ependymoma was diagnosed by MRI.The lesion was surgically removed from the patient.

CONCLUSION

In conclusion, in certain serious pathologies, such as vertebral osteomyelitis, primary neoplasms of the vertebrae, intradural tumors, and metastatic vertebral lesions, persistent low back pain may be the only presenting symptom without changing biochemical or hematological parameters or showing up on plain radiographs.Low back discomfort may be the only symptom of lower abdominal or pelvic diseases.When it comes to identifying significant spine diseases such osteomyelitis and primary or secondary neoplasms, plain radiography has a low sensitivity.Since most spine pathologies, such as degenerative, infectious, and neoplastic lesions, only show detectable changes in plain radiographs when they are progressed, plain radiographs are not helpful in the early diagnosis of these conditions. When low back pain is present, magnetic resonance imaging is a noninvasive and extremely sensitive way to assess the spine.The most frequent abnormalities discovered during MRI examinations of patients with low back pain are disc degeneration and other degenerative alterations.In these situations, lumbar disc herniation is a frequent occurrence.It's still up for dispute to what extent these alterations cause low back pain.When it comes to identifying and distinguishing lesions of various origins, including degenerative changes, infectious lesions, cancers, congenital and developmental problems, compression fractures, and numerous other rare spine diseases, magnetic resonance imaging (MRI) is extremely sensitive.Our research revealed that MRI had a 100% sensitivity in cases of malignant spine lesions and infective spondylitis.

REFERENCES

1. Jarvik JG, Hollingworth W, Martin B, Emerson SS, Gray DT, Overman S et al. Rapid magnetic resonance imaging vs radiographs for patients with low back pain: a randomized controlled trial. JAMA. 2003 Jun 4;289(21):2810-8.
2. Kim SH, Bak KH, Kim DW, Kang TH. Primary intramedullary spinal sarcoma: a case report and review of the current literatures. J Korean Neurosurg Soc. Nov 2010;48(5):448-51.
3. Modic T. Michael, Jeffrey S. Ross. Lumbar Degenerative Disk Disease. Radiology 2007:245,43-61.
4. Smith AB, Soderlund KA, Rushing EJ, Smirniotopolous JG. Radiologic- Pathologic Correlation of Pediatric and Adolescent Spinal Neoplasms: Part 1, Intramedullary Spinal Neoplasms. AJR 2012; 198:34–43.
5. Czervinke H: umnar IV disc disease. Neuroimag. Clin North Am 1993; 3:465486.
6. Paajanen H, Erkintalo M, Kuusela et al. Resonance study of Disc degeneration in young low back pain patients: Spine 1989; 14:982-985.
7. Cheung KM, Karppinen J, Chan D Prevalence and pattern of lumbar magnetic resonance imaging changes in a population study of one thousand forty-three individuals. Spine 2009: 20;34(9):934-40.
8. Takatalo J, Karppinen J, Niinimaki J, Taimela S, Nayha S, Jarvelin MR, Kyllonen E, Tervonen O, 2009 Prevalence of degenerative imaging findings in lumbar magnetic resonance imaging among young adults. Spine 2009 July 34(16):1716-21.
9. Sivas Acar Filiz, Deniz Cılız, Uğur Erel, Esra ErkolÐnal, Kürsat Özoran, Bülent Sakman. Abnormal Lumbar Magnetic Resonance Imaging in Asymptomatic Individuals, 2009 Turk J Phys Med Rehab; 55:73-7.
10. Matijsaitis V, Vaitkus A, Pauza V, et al. Neurosyphilis manifesting as spinaltranverse myelitis. Medicina Kaunas 2006;42(5):401–405.
11. Dahnet Wolfgang. Radiology Review Manual 2007. 6th Edition, 2007 Lippincott Williams & Wilkins. Philadelphia, Pennsylvania. Central Nervous System. Disk degenerative disease; pg 202/3/24.
12. Ducati LG, Silva MV, Brandão MM, Romero FR, Zanini MA. Intradural lumbar disc herniation: report of five cases with literature review. Eur Spine J. 2013 May;22 Suppl 3: S404-8.
13. Savage RA, Whitehouse GH, Roberts N: The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain. Age and occupation in males. Eur spine J 1997; 6:106-114.
14. Weishaupt D, Zanetti M, Hodler J, Boss N: MR imaging of the lumbar spine: Prevalence of intervertebral disc extrusion and sequestration. Nerve rootcompression, End plate abnormalities and Osteoarthritis of the facet joints inasymptomatic volunteers. Radiology 1998; 209:661-666.
15. Modic MT, steinberg PM, Ross JS et at: Degenerative Disc Disease: Assessment of changes in vertebral body marrow with MR imaging. Radiology 1988; 166:193- 199.
16. Sharif SH: Role of MR imaging on the management of spinal infections. AJR 1992; 158:1333-45.
17. Osborne AG; Tumors cysts and tumor like lesion of the spine and spinal cord. Diagnostic Neuroradiology 1994, Mosby Year book. Inc St Lousis Missouri.