



A RETROSPECTIVE STUDY ON MAGNETIC RESONANCE IMAGING ASSESSMENT OF DEGENERATIVE DISEASE OF THE LUMBOSACRAL SPINE.

Radiodiagnosis

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ABSTRACT

OBJECTIVE: Main purpose of our study is to evaluate the extent, characterization, and changes associated with the degenerative disease of lumbosacral spine by Magnetic Resonance Imaging.

MATERIALS AND METHODS: This study is a retrospective study conducted on 50 patients with lower backache segregated based on age and level of lumbar spine involvement for a period of 12 months (Sep 2019 to Aug 2020). MRI lumbosacral spine was performed on 1.5 Tesla Siemens MRI machine using the required protocol and sequences, whereby MRI findings ascribed to Degenerative Disease of the Lumbosacral Spine were analysed.

RESULTS: The mean age of the study participants was 52 years $\pm$ 10 years with a Male: Female ratio of 1.5:1. The L4-L5 intervertebral disc was the most frequently and most severely involved level irrespective of age and gender. Disc degeneration was the commonest manifestation seen (100%) followed by nerve root compression (72%), disc herniation (70%), spinal canal stenosis (58%), facet joint arthropathy (42%), ligamentum flavum hypertrophy (30%) and Modic endplate degenerative changes (26%) in decreasing order of frequency.

CONCLUSION: MRI is the modality of choice for evaluation of Degenerative Disease of the Lumbosacral Spine and allows precise assessment of spinal canal stenosis. Hence it is recommended as mandatory in the workup of all patients with the chief complaint of low backache irrespective of the presence or absence of radiculopathy/neurological deficit.

KEYWORDS

Lumbo-sacral spine, Degenerative disease, intervertebral disc, ligamentum flavum

INTRODUCTION:

- Low back pain is an exceedingly common problem, with a lifetime prevalence of 70% to 85%.¹
- The etiology of low back pain is multifactorial and is influenced by genetics, age, sex and mechanical stresses.²
- Degenerative Disease of the Lumbosacral Spine is the commonest cause of low back pain worldwide irrespective of age & gender and hence a common referral to the radiologist.³
- Imaging plays a critical role in the diagnosis of low back pain. MRI has become a mainstay in the workup of low back pain due to its excellent soft tissue contrast, cross-sectional capability, and lack of ionizing radiation.⁴
- A variety of biochemical and structural changes take place in the spine during the process of aging and degeneration.
- Paula De Candido et al, in their MRI based study on distribution of degenerative changes in lumbar spine concluded that these degenerative changes increase with age and affect predominantly lower lumbar spine.⁵
- MRI particularly enables direct visualization of the soft tissue components of the spinal column and hence pinpoints the precise relationship between the herniating disc and the regional nervous structures (nerve roots and spinal cord) as well as intervertebral foramina.⁶
- Thereby MRI facilitates an in-depth review of both the static as well as the dynamic causative agents for Spinal Degenerative Disease. Additional benefits include a holistic view of the entire vertebral column on the whole spine screening sequence which further contributes to the diagnostic yield.⁶⁻⁷

OBJECTIVES:

- To evaluate the extent and characterization of degenerative disease of lumbosacral spine.
- To evaluate changes associated with the degenerative disease of lumbosacral spine by Magnetic Resonance Imaging

MATERIALS AND METHODS:

Study Design: The present study was carried out in the Department of Radiodiagnosis at Alluri Sitarama Raju Academy of Medical Sciences (Eluru). It is a retrospective cross-sectional observational study of two months duration.

All patients referred with the chief complaint of low back pain & with findings ascribed exclusively to Degenerative Disease of the Spine on

subsequent MRI were included in the study. A total of 50 such patients fulfilling the inclusion and exclusion criteria were enrolled in the present study

INCLUSION CRITERIA: Patients with history of low back pain with or without radiculopathy or neurological symptoms and with imaging features of Degenerative Disease of the Lumbosacral Spine as the sole pathology on the subsequent Dedicated MRI examination

EXCLUSION CRITERIA: Patients with history of prior spine surgery, spinal fractures, metabolic bone disease, spinal infectious pathologies, malignancy, Ankylosing Spondylitis or Fluorosis

PROCEDURE: A non – contrast Multiplanar and Multi-sequence Evaluation was done on a 1.5 Tesla MRI scanner, Siemens magnetom avento Syngo (MR D-13) 16 channel in non-weight bearing position. The region of interest included Dorsal vertebra 12 (D12) to S1 sacral segment using predetermined parameters. The images were acquired as conventional T1 TSE and T2 TSE weighted in axial and sagittal planes, T1 STIR in sagittal and coronal planes as well as T2 TIRM COR sequences. Additional series were also carried out to generate a Whole Spine Sagittal Screening Image.

Statistical Analysis: Data entry and analysis was done on Microsoft Office Excel version 2019 and SPSS version 23. Most of the data was expressed in percentages while difference was statistically analysed

RESULTS:

- The study included 50 patients with age range from 30 to 78 years (mean: 52 years $\pm$ 10 years) with majority being male (66%) while females comprised only a third of the study population (34%).
- The overall prevalence of spinal degenerative findings in descending order of frequency was disc degeneration (commonest manifestation seen in N=100; 100%) followed by nerve root compression (72%), disc herniation (70%), spinal canal stenosis (58%), facet arthropathy (42%) and ligamentum flavum hypertrophy (30%). Modic type endplate degenerative changes (26%) were the least common finding of this spectrum

Table:1: prevalence of spinal degenerative findings

Spinal degenerative findings	Prevalance
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Disc Degeneration	100%
Nerve root compression	72%
Disc herniation	70%
Spinal canal stenosis	58%
Facetal arthropathy	42%
Ligamentum flavum hypertrophy	30%
Modic end plate degenerative changes	26%

Table: 2: Gender - wise Distribution of Imaging Spectrum of Degenerative Disease of the Lumbosacral Spine

Degenerative findings	Males	Females	Total
Disc Degeneration	33(100%)	17(100%)	50(100%)
Nerve root compression	22(61.1%)	14(38.8%)	36(72%)
Disc herniation	21(60%)	14(40%)	35(70%)
Spinal canal stenosis	16(55%)	13(45%)	29(58%)
Facetal arthropathy	12(57%)	9(43%)	21(42%)
Ligamentum flavum hypertrophy	10(66.6%)	5(33.3%)	15(30%)
Modic end plate degenerative changes	8(61.5%)	5(38.4%)	13(26%)

- The overall prevalence as well as severity of Spinal Degenerative Disease was directly proportional to advancing age with advanced degenerative changes seen in all patients above 60 years of age and was statistically significant. Bulging discs were an exception with a higher prevalence in the relatively younger age group but this difference was not statistically significant.
- The overall prevalence as well as more severe manifestations of Spinal Degenerative Disease were more frequently observed among males but this difference was not statistically significant.
- Disc degeneration was the most frequent finding (N=100; 100%) with L4-L5 Disc being the single most commonly affected level (74%). Multilevel involvement was more frequent in the older subjects. The occurrence of these changes in the younger patients was likely due to repetitive microtrauma ascribed to bad posture and physical loading. This was in consonance with similar studies carried out in the past⁸⁻⁹
- Disc herniations were seen in majority of patients (70%) with males having higher prevalence than females but was statistically not significant. Overall, the vast majority of the herniations (94%) were protrusions while a minority (6%) were extrusions. Among these the posterocentral & paracentral were the most common zones (combined 92%) while exclusively foraminal and extra-foraminal were far less common (6% & 2% respectively).
- Nerve root compression correlated directly with more severe disc herniations/protrusions; with additional worsening effect due to coexistent facetal arthropathy and ligamentum flavum hypertrophy at the respective discal level wherever present.
- Traversing nerve roots were more frequently compressed due to posterocentral and paracentral herniations while exiting nerve root compression was associated more with foraminal & extra-foraminal zone herniations. Exiting nerve root compression correlated well with all cases referred with radiculopathy/ sciatica.
- The presence as well as severity of Facetal Arthropathy as well as Ligamentum Flavum Hypertrophy exhibited direct correlation with advancing age (both seen to varying degrees in 100% patients more than 60 years of age) with L4-L5 intervertebral level being the single most commonly involved level irrespective of age and sex of the study subject

Representative cases



Figure 1: MRI Lumbo-sacral spine T2 sagittal sections showing Disc degeneration at multiple levels



Figure 2: MRI Lumbo-sacral spine T2 sagittal sections showing disc extrusion with superior migration at L4-L5 level



Figure 3: MRI Lumbo-sacral spine T2 sagittal sections showing modic end plate changes at multiple levels

DISCUSSION:

- The MRI findings were analysed in all 50 patients with features of Degenerative Disease of the Lumbosacral Spine alone without any comorbidities in accordance with inclusion and exclusion criterias. All the acquired views and sequences were analysed and observations compiled methodically into age & sex-based as well as frequency-based categories
- The most frequent as well as severe changes were consistently observed at the L4-L5 level irrespective of age and sex of the study participant. This was explainable due to this level of the Lumbar Spine being more prone to weight bearing and resultant repetitive microtrauma related changes similar to previously done studies by Ong *et al.*⁹

- Disc Degeneration of varying degrees was the commonest MRI correlate in all these cases across all categories seen at single/ few/ multiple vertebral levels in all cases. However, the disc bulges were seen to be more frequent among the younger subjects while herniations were more frequently encountered in the elderly
- The Discal Herniations were categorised as per the Combined North American Task Force Society Recommendations and the vast majority of these were protrusions with extrusions seen in the minority of individuals. Two among these exhibited Sequestered discs with migration (one each with the cranial and caudal respectively).
- Spinal Central Canal Stenosis of varying degrees was uniformly seen in all cases with discal herniations of the posterocentral and paracentral zones as well as in those with significant posterior disc bulges with no significant sex-related variation in the study group as a whole. This was in agreement with similar observations noted in the study by Shobeiri *et al.*¹⁰
- Ligamentum Flavum Hypertrophy as well as Facetal Arthropathy were increasingly encountered in the older individuals with resultant aggravation of the pre-existing discogenic central spinal canal stenosis.
- Modic Type End Plate Degenerative changes were the least frequently encountered finding but exhibited a definite age proportional trend similar to findings by Kuisma *et al.*¹¹. This was likely ascribed to physiological ageing related changes in the older study subjects. Also, to be noted is the observation that Type II changes were more frequently seen.

CONCLUSION:

- MRI is the modality of choice for evaluation of Degenerative Disease of the Lumbosacral Spine and allows most precise assessment of central spinal canal stenosis.
- MRI has a key role in the accurate evaluation of Degenerative Disease of the Lumbosacral Spine. Its ability to assess the Functional Spinal Unit inclusive of the normal anatomy, discal composition & architecture and central spinal canal stenosis all justify and approve of its indispensable role in the radiological workup of such cases.
- It is hence highly recommended to be carried out in all MRI compatible and safe scenarios in patients with low back pain irrespective of the presence or absence of radiculopathy and /or neurological symptoms

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