DOI: 10.7860/IJARS/2017/27565:2302

Original Article

Radiology Section

Can MRI Localise the Cause of Chronic Low Backache in Lumbar Spondylosis and Help Guide Specific Management?

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ABSTRACT

Introduction: MRI is a primary imaging modality in assessing chronic low backache. Many of the findings identified on MRI may not be symptomatic. Nerve root compressions, compression of cauda equina, posterior annular tear, facetal arthropathy are more likely to be symptomatic. Management of each of these pathologies vary. It is essential to identify the pathologies that can cause pain and symptoms in lumbar spondylosis.

Aim: To identify the specific finding/pathology on MRI that corresponds to the clinical presentation of the patient with lumbar spondylosis.

Materials and Methods: The study was done between May and December 2016 and included 100 patients who were referred for MRI of lumbosacral spine with history of debilitating backache for more than 2 weeks. After ruling out other causes, clinical evaluation of patients was done to localize level; and type of pain. T1, T2 weighted and STIR imaging of lumbo-sacral spine was done. The images were studied to localize the pathology which most likely caused the pattern of pain the patient experienced.

Results: The study included 55 ladies and 45 men. 42 people had radiculopathy. In 86% of cases, MRI helped in localizing the exact pathology responsible for the pattern of pain, the patients experienced. Nerve compressions were seen in 86% of patients with radiculopathy. Among the people without radiculopathy, the cause for pain could be localized in 86%. The most common cause of pain identified was horizontal posterior annular fissure (40%).

Conclusion: In a significant number of patients with chronic low backache, we can identify the specific pathology that corroborates with the clinical symptomatology of the patient. This aids in guiding specific management to provide symptomatic relief.

Keywords: Facetal arthropathy, Nerve root compression, Posterior annular tear, Radiculopathy

INTRODUCTION

Low backache is one of commonest presenting complaint in Outpatient Departments [1]. Most of these patients are subjected to non specific treatment in the form of pain killers and some form of physiotherapy and some undergo surgery as well without much relief. The low backache may sometimes be disabling causing loss of man hours and productivity [2,3].

MRI has evolved to be a primary imaging modality in assessing chronic low backache. It is not uncommon to find multi-level degenerative changes in the spine on MRI. Many of such findings may not be symptomatic at all. Not all degenerative intervertebral disc herniations cause pain. Hence, it is essential to identify the pathologies that can cause pain and symptoms in lumbar spondylosis. Disc herniations causing nerve root compression, compression of cauda equina or significant spinal canal stenosis, annular fissures in the disc are more likely to cause pain [4-7]. Facetal arthropathy is a common cause of low backache due to high mobility and load bearing [8].

Available treatment options for management of each of these pathologies vary. For example pain due to facetal arthropathy can be targeted by facetal joint infiltration with painkiller with or without steroid, which will provide relief for a considerable time [9,10]. Surgery is not a primary option in this case. Similarly, pain due to nerve root compression may be due to a large disc herniation, which may require microdiscectomy or a decompressive surgery [11]. An acute Schmorl's node may require vertebroplasty especially in a setting of osteoporosis. Horizontal posterior annular tear or fissure without a prominent disc usually heals with conservative therapy including mild forms of physiotherapy and pain killers [12].

The management must be aimed at that particular causative pathology to provide adequate relief to the patient.

In this study, it is attempted to identify and localize the pathology on MRI which will correspond to the clinically identified level and type of low backache in patients with degenerative disc disease.

MATERIALS AND METHODS

A prospective study was done in the Department of Radiodiagnosis of a Tertiary Care Hospital in Karnataka, India, between the peroid of May to November 2016, which included 100 patients referred for MRI of lumbosacral spine with history of debilitating backache for more than 2 weeks. Sample size was calculated using precision based sample size calculators. Institutional ethical committee clearance was taken prior to the study.

Clinical evaluation of patients was done to ascertain that the likely cause of low backache was spondylosis/degenerative etiology. Extraspinal causes of backache like renal causes, were ruled out by detailed history taking, clinical examination and wherever necessary subsidiary procedures including ultrasonography. Patients with history of trauma, suspicion of vertebral metastases, infections, spinal cord tumours and any contraindications for MRI were not included in the study. Cases with spinal cord oedema/lesions, myelomalacia, traumatic injury detected on MRI were excluded from the study.

Patients with referred pain, numbness, reduced tendon reflexes were clinically considered to have nerve root compressions/compression of cauda equina. The spinal level of involvement was ascertained based on the dermatomes to which the pain radiates, as also other features like tendon reflexes affected and bowel and bladder disturbances [13]. The spinal level of pain without radiculopathy was ascertained by focal level of pain and tenderness. MRI of lumbosacral spine was performed using a 1.5 Tesla (Philips, Achieva) MRI scanner after taking informed consent of the patient. The MRI protocol followed was as per [Table/Fig-1].

The images obtained were carefully studied to localize the pathology which most likely caused the pattern of pain the patient experiences. Though, all other findings were recorded in the report, but not included in this study. Exiting and traversing nerve root compressions were analysed in sagittal and axial T2 weighted images. Complete loss of fat on all sides of the nerve root was deemed compression [14]. Ligamentum Flavum hypertrophy and available spinal canal area were measured on axial images. Any value of more than 3 mm thickness of ligamentum flavum was considered hypertrophy. A value of less than 12 mm of the spinal canal midsagittal diameter was identified as significant secondary spinal canal stenosis [15]. Sagittal T2 and T1 weighted images and coronal STIR images were used to identify endplate changes of the vertebral bodies, as well as any break in pars inter articularis.

Sequence	TE (Time to Echo) (in milli-seconds)	TR (Repetition Time) (in milliseconds)	Slice thickness (in milli-metres)	No of signal (averages)
Turbo Spin Echo T2 Sagittal	120	3000	4 mm	4
Spin Echo T1 Sagittal	8	400	4 mm	4
Turbo Spin Echo T2 Axial (at Disc level)	120	3694	4 mm	4
STIR (Short tau inversion recovery) Sagittal	80 TI (Inversion time) - 150	3500	4 mm	4

[Table/Fig-1]: MRI protocol parameters used in the present study.

The results were tabulated and the clinical findings were matched with the specific pathology found on MR imaging in each patient. Percentage of various findings causing patient symptoms was calculated.

RESULTS

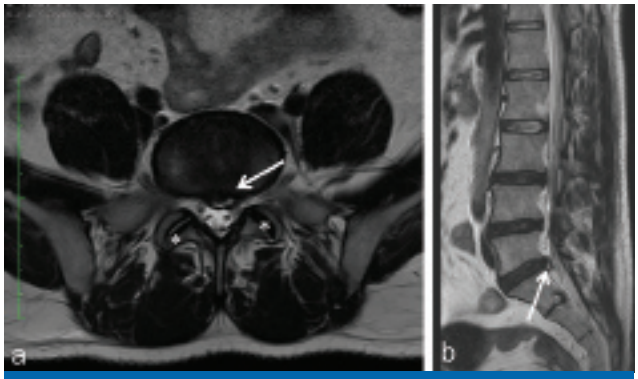
The study included 55 females and 45 males. The mean age of the cases was 45.5 years. The youngest was 24 years old and the elder most was of 85 years old.

On clinical examination it was found that 42 people had radiculopathy of which 12 persons had bilateral radiculopathy and 30 had unilateral radiating low backache. The most common dermatomal distribution of the referred pain among these patients was at L4 and L5 levels (90%). No patient complained of bowel and urinary bladder disturbances. five patients presented with pain referred to multiple overlapping dermatomes.

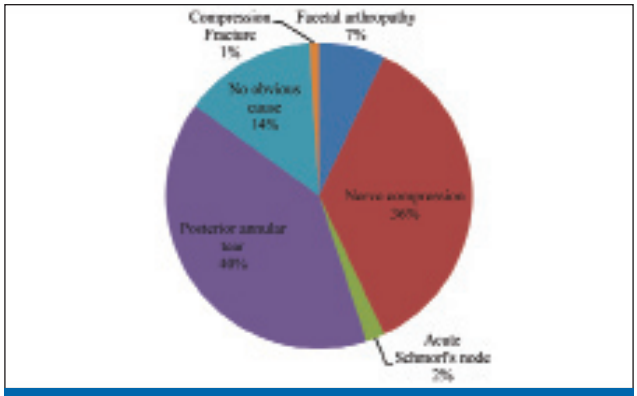
In 86 of the 100 individuals, MRI helped in localizing the exact pathology responsible for the pattern of pain the patients experienced. MRI was able to identify nerve compressions in 36 of 42 patients with radiculopathy (86%). Among the people without radiculopathy, the cause for pain could be localized in 50 out of 58 cases (86%).

The most common cause of pain identified was horizontal posterior annular fissure or tear (40 cases) [Table/Fig-2a,b]. This was followed by nerve compressions (36 cases), severe facetal joint degenerative arthropathy (7 cases), acute Schmorl's nodes (2 cases) and osteoporotic compression fracture of the vertebral body (1 case) as depicted in [Table/Fig-3].

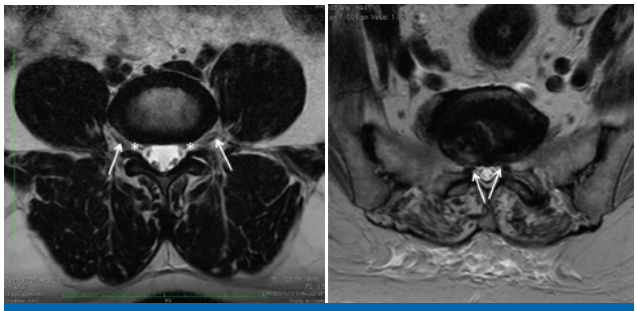
The normal appearances of exiting, traversing nerve roots are demonstrated in [Table/Fig-4]. Of the 36 people with nerve compressions, 27 (75% of radiculopathy) were found to have traversing nerve root compressions [Table/Fig-5], 6(17%) had compression of cauda equina [Table/Fig-6] and 3 (8%) had exiting nerve compressions [Table/Fig-7,8]. In all these cases



[Table/Fig-2a,b]: T2 weighted axial (a) and sagittal (b) images in a 27 year male without radiculopathy showing central horizontal posterior annular tear (white arrow) with disc extrusion. Also note normal appearing facetal joints (asterisks)

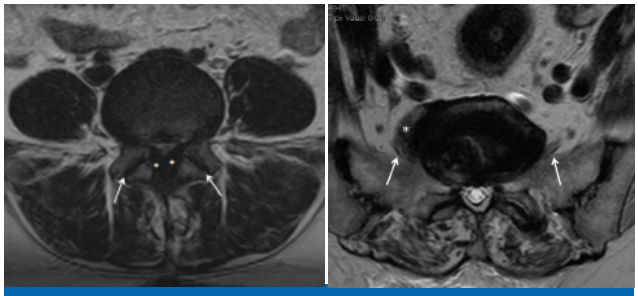


[Table/Fig-3]: Pie chart showing the percentage of findings localized on MRI which were correlating with the patient's clinical presentation.



[Table/Fig-4]: A T2 weighted axial image at intervertebral disc level, in a 32 years old male with chronic low backache, demonstrating normal appearing exiting nerves (white arrows) and traversing nerve roots in the lateral recesses appearing as grey dots just adjacent to white asterisks. **[Table/Fig-5]:** T2 weighted axial image at intervertebral disc level at L4-5 level, demonstrating bilateral traversing nerve roots (white arrows) being compressed in the lateral recesses by altered contour of disc (white arrows), in a 64 years old patient with bilateral lumbar radiculopathy.

posterior disc herniations were noted, disc protrusions being the commonest form (75%). There were disc extrusions with variable migration in 20% of cases. Superiorly sequestered disc causing exiting nerve root compression was seen in 1 case [Table/Fig-9].



[Table/Fig-6]: T2 weighted axial image at L3-4 intervertebral disc level in a 59 years old lady with multi level bilateral radiculopathies, demonstrating bilateral ligamentum flavum hypertrophy (white asterisks) and together with disc herniation causing cauda equina compression. Degenerative changes are noted in bilateral facet joints (white arrows). **[Table/Fig-7]:** T2 weighted axial image at L4-5 intervertebral disc level, in a 57 years old female presenting with right L4 radiculopathy, demonstrating an extraforaminal disc herniation (white asterisk) on right side which is causing indentation of the right exiting nerve root (white arrow). Normal appearing left exiting nerve (white arrow on contralateral side) root is also seen.

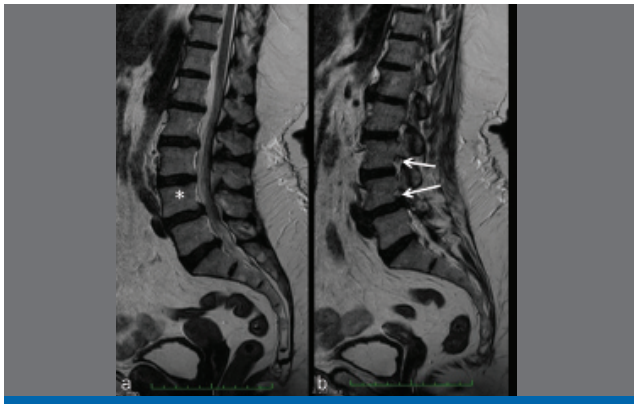
Compression of cauda equina was a result of varying combinations of posterior disc herniations, ligamentum flavum hypertrophy [Table/Fig-6]. Facetal joint hypertrophy and anterolisthesis. Though, most cases of lumbar spinal canal stenosis also showed facetal arthropathy, such facet joints were not considered separately, as the radiculopathy symptoms were considered to be primarily due to compression of cauda equina.

Four patients with severe facetal arthropathy had Grade I anterolisthesis [Table/Fig-8] and one patients had retrolisthesis. 2 had bilateral spondylolysis. All cases with facetal arthropathy had some form of posterior disc herniation, not causing nerve compressions.

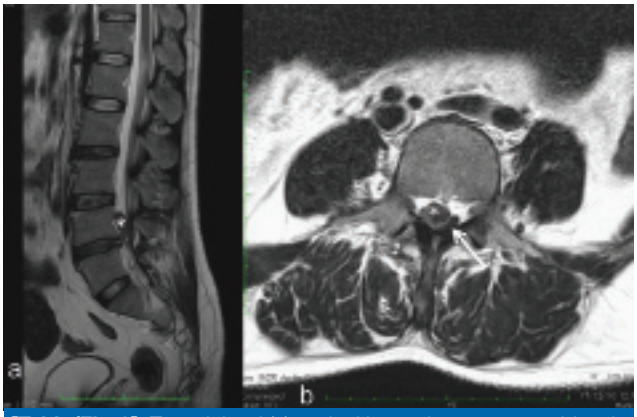
There were two cases with acute Schmorl's nodes at vertebral endplates identified as focal end plate depressions with adjacent bone oedema as depicted in [Table/Fig-10]. These were found at superior endplates of L1 and L2 bodies, which were corroborating with the levels of focal tenderness. One elderly lady had a osteoporotic compression fracture of L1 vertebral body which correlated with her pain, though no obvious history of injury could be elicited.

On MRI, the most frequent level of disc abnormality leading to nerve compressions was seen at L4-5 (44%) followed by L5-S1 level (32%).

In 14 out of 100 cases, no pathology matching with patient's presentation could be identified. Six of them had normal MRI studies, all of whom were young and in their 3rd and 4th decades of life. In the remaining 8 cases, though multiple degenerative changes of the lumbar intervertebral discs could be identified, none of them were specifically corroborating with the clinical findings. For instance, one person aged 64 years was clinically diagnosed to have radiculopathy at L3 and L4 levels



[Table/Fig-8]: T2 weighted (a) Mid sagittal image in a 54 years lady shows Grade I anterolisthesis of L4 (white asterisk) over L5 vertebral body. (b) left parasagittal image in the same patient with white arrows indicating exiting nerve roots in the neural foramina. There is narrowing of left neural foramen at L4-5 level with near complete obliteration of fat around the L4 exiting nerve root. Left L3 exiting nerve root in normal appearing neural foramen at L3-4 level is also seen.



[Table/Fig-9]: T2 weighted (a) sagittal image in a 42 years old male shows sequestered disc (asterisk) which has superiorly migrated from L4-5 level. (b) Axial image in the same patient shows the sequestered disc in the anterior epidural space causing displacement and compression of the dural sac (white arrow).

[Table/Fig-10]: Acute Schmorl's nodes (a) STIR sagittal image in a 49 years old male with severe chronic low backache with focal tenderness, showing focal superior end plate depressions at L1 and L2 with hyperintensities. (b) T1 sagittal image in the same patient show endplate hypointensities in corresponding locations.

bilaterally. Though, small posterior disc protrusions and early degenerative changes of facetal joints were identified at those levels, these were not causing compression of nerve roots or cauda equina, hence unable to explain the radiculopathy. Such cases were labeled as not localised on MRI. Similarly, even if one clinical finding could not be matched on MRI, they were deemed not localized.

DISCUSSION

MRI of Lumbosacral spine, often, opens a pandora's box, in which multiple degenerative pathologies can be identified at more than one level, especially in elderly. However, not all the findings are likely to be causative of the patient symptoms. In addition, due to a large number of findings, there is a possibility that the culprit lesion will assume less significance or get totally masked by some obvious findings, which otherwise do not contribute to patient suffering. This results in inappropriate management. Moreover, the management strategies of different pathologies also vary. Hence, the focus should be towards identifying the finding which will match the pattern of clinical presentation. Here comes the role of comprehensive clinical evaluation prior to MRI, first to rule out extra spinal causes of chronic low back ache and then to identify the pattern of pain and correlate it with the spinal level. Once this is done it is easy to localise the causative pathology on MRI images.

In the present study, in 86% of cases, the pathology that is most suiting to cause the pattern of presentation could be identified. This is in concordance to studies by Bajpai J et al., (87%) [16], Masui et al., [17].

Chronic low backache with radiculopathy was present in 42% of cases of which 29% had bilateral occurrence. 90% of these patients had pain along the L4 and L5 dermatomes. Vroomen PC et al., had found such radiating pain in 67% of the study sample and nerve compression noted in 56% of people, which suggests that 83% of people with radiculopathy had demonstrable nerve root compressions on MRI [6]. This is in accordance to the present study where such nerve compressions could be identified in 86% of cases with radiculopathy.

Bajpai J et al., also found radiculopathy in 54% cases, but could pinpoint nerve root compressions only in 44% of patients with radiculopathy on MRI [16].

The most common causative factor for low backache identified in this study was horizontal posterior annular tear/fissure, which was localized in 40% of cases. This was followed by traversing nerve root compressions, compression of cauda equina secondary to lumbar canal stenosis and facet joint degenerative arthropathy.

The most common level of degenerative disc changes

identified as causative pathology for backache was L4-5 level (44%), followed by L5-S1 level (32%). This is in accordance to the study by Bajpai J et al., which found L4-5 level involvement in 36% [16] as also study by Modic et al., which found L4-5 involvement in 43% [18].

Another interesting observation made in this study is regarding the significance of critical measurements identified for ligamentum flavum hypertrophy, Lumbar canal stenosis etc. Though many cases showed ligamentum flavum of more than 3 mm thickness along with lumbar spinal canal diameters of significantly less than 10 mm, not all showed symptoms. At the same time, in a few cases, lumbar canal dimension of even 11 mm was correlating well with their clinical presentation. Hence, more than the dimensions, significance should be attached to the clinical correlation of such findings.

Based on the findings of this study, it is proposed that while reporting MRI of lumbosacral spine in a degenerative etiology, clinical pattern and spinal level of pain should be specifically sought and the finding which is most likely to cause such pattern of symptoms, must be emphasized, instead of just enumerating all visible findings.

LIMITATION

In 14 cases, the causative pathology could not be matched and localised on MRI. This could be due to paraspinal muscle spasms, inappropriate posture, inability to accurately localize the distribution of pain on clinical examination, reduced threshold for pain, physiological changes, especially in females etc.

In this study, it was possible to more accurately localize the pathology in young individuals and it was difficult to pinpoint towards a single causative pathology in elderly. This was due to complexity of clinical presentation and multiplicity of findings on MRI. There is a possibility of dynamic compression of nerve roots and cauda equina, which was ignored in this study. These may be demonstrated with dynamic flexion and extension MRI studies.

However, inspite of this shortcoming, a normal MRI or few insignificant changes on MRI, practically rule out the need for major spine related interventions. In some cases, it also helps to divert the attention towards nonspinal causes for the pain, which will further help patient get appropriate remedies. No post treatment clinical follow-up of patient was done. This was a limitation in terms of not assessing the benefits accrued by the patient after being guided for appropriate management. This also could have confirmed the causal relationship of the MRI finding with the patient's symptoms.

CONCLUSION

Not all disc herniations identified on MRI cause low backache. Therefore, it is essential to identify the pathology that corroborates with the clinical symptomatology of the patient. It is recommended that the MRI reports of lumbosacral spine should mention the symptom pattern of patient and also specifically emphasize on the corresponding finding on MRI that explains the clinical presentation, whenever possible. This aids in guiding the patient towards specific management strategies.

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FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date of Publishing: **Oct 01, 2017**