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MRI evaluation of Spectrum of Spinal Canal Stenosis and Nerve Root Compression in Patients With Low Back Pain

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Abstract

Background: The prevalence of low back pain (LBP) in Indian population has been found to vary between 6.2% (in general population) to 92% (in construction workers).

Many structural components of spine are responsible for low backpain of degenerative etiology including the thecal sac, spinal cord, intervertebral disc, vertebral periosteum, facet joints and spinal ligaments.

Aims: The aim of this study was to assess the role of MRI in the evaluation of spinal canal stenosis and nerve root compression in patients with low backpain.

Material and Methods: This cross-sectional study was conducted on forty patients with chief complaint of low back pain

Results: Of the 400 patients evaluated with MRI lumbosacral spine for low backpain, spinal canal stenosis was seen in 190 patients (47.5%). Of the 400 patients evaluated with MRI lumbosacral spine for low back pain, nerve root compression was seen in 300 (75.0%) patients, with maximum number of patients having nerve root compression at L_4-L_5 disc level.

Conclusion: It was concluded that MRI is a useful and safe modality for the evaluation of lumbar vertebral pathologies involving spinal canal stenosis and nerve root compression in patients with LBP.

Keywords: low backpain, MRI, nerve root compression, spinal canal stenosis

Introduction

The prevalence of LBP in Indian population has been found to vary between 6.2% (in general population) to 92% (in construction workers).

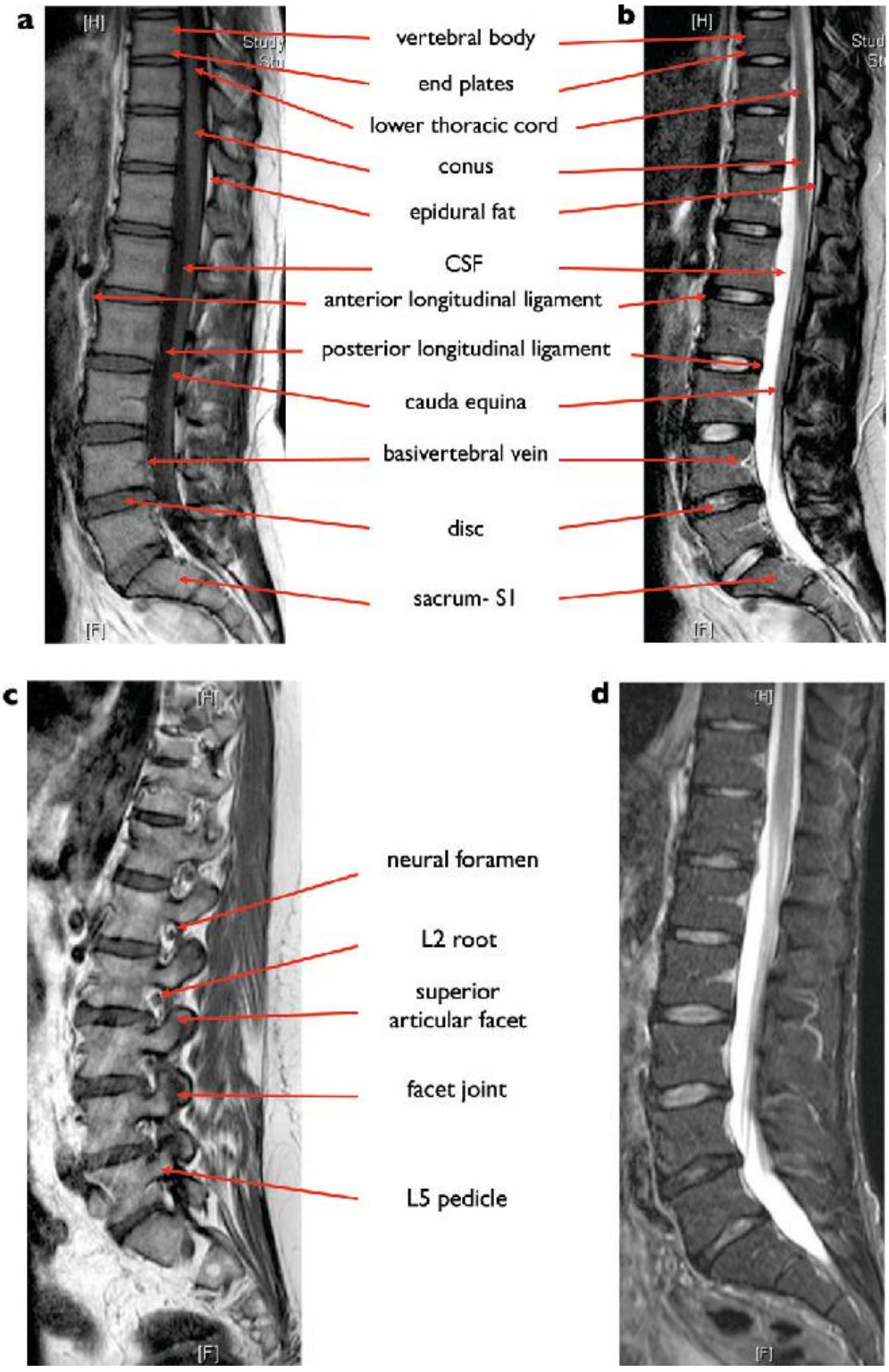
Many structural components of spine are responsible for low backpain of degenerative etiology including the intervertebral disc, vertebral periosteum, facet joints and spinal ligaments.

Dura Mater, Intradural Space, and Spinal Cord

The dura mater forms a sleeve around the subarachnoid space, covering the cord and intracanal component of the nerve roots. It extends beyond the canal to fuse with the perineurium of the spinal nerves.

In the lumbar area, the dura terminates at the level of S2 and fuses with the filum terminale to end at the coccyx. The lumbar canal contains the conus, the cauda equina, and the filum terminale. The conus medullaris continuous with the spinal cord ends at the L1-2 level with a taper, then becomes the filum terminale. Normally, the conus is above the mid L2 level and the filum terminale is 2 mm or less in thickness at the level of the L5-S1 interspace. On T1 images, the spinal cord is clearly seen because of its isointensity surrounded by the low signal intensity of CSF. On T2 images, these signals reverse, and the

decreased signal of the cord and roots of the cauda equina are outlined by high-signal CSF.



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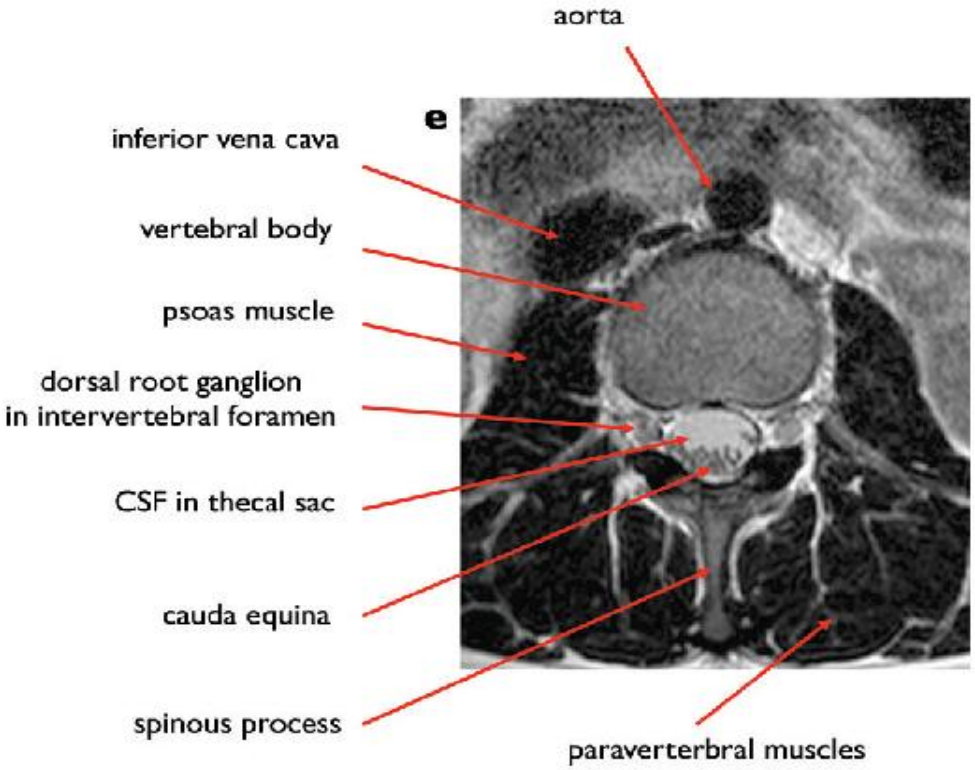

FIGURE 1: MRI depicting normal anatomy of lumbar spine. T1weighted (A), T2 weighted (B), and short-tau inversion recovery (STIR) (D); sagittal images, T1 weighted parasagittal (C), and T2 weighted axial (E), images of the lumbar spine. STIR images (D), T2WI suppressing the high-signal from fat are excellent for assessing marrow infiltration. CSF, cerebrospinal fluid.

Central Canal Stenosis : Spinal stenosis can occur for various reasons, such as congenital spine abnormalities and disc herniation, but classically consists of the triad of disc bulge with facet hypertrophy and hypertrophy of the ligamentum flavum. In general, MRI is considered the best approach for the workup of spinal stenosis.[1] The reported sensitivity and specificity of MRI for the diagnosis of spinal stenosis varies from 77% to 90% and 72% to 100%, respectively, with the reference standard in studies consisting of either surgical findings or adequate clinical follow-up. [2] T1-weighted images can clearly visualize stenosis and provide valid information regarding the underlying cause of stenosis.

Materials And Methods

This cross-sectional study was carried out on 400 patients with chief complaint of low back pain in Department of Radio diagnosis at a tertiary health care centre in North India which were referred to the department for MRI from the outpatient department of orthopedics. A detailed history along with complete clinical examination was done before the MRI examination.

Patient Preparation

Before evaluating the patient by MRI imaging informed consent was obtained from the patient or guardian and the procedure was briefly explained to the patient or guardian. Approval from Institutional Ethical committee was taken.

Inclusion Criteria:

1. Patients of age (20-65 years) with chief complaint of low back pain who were referred for MRI to Department of Radiology at a tertiary health care centre in North India.
2. Radicular low back pain radiating to one or both lower limbs.
3. LBP Associated with neurological deficits including bowel and bladder disturbances.

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4. LBP with some infective, neoplastic or truamatic history.

Exclusion Criteria:

1. Patients having cardiac pacemakers and electromagnetic implants.
2. Non manageable severe claustrophobia.
3. Age (less than 20 years and more than 65 years)
4. Patient who refused to give consent.

Study Equipment:

- SIEMENS 1.5 TESLA MRI superconducting magnet. Standard surface coils and body coils for lumbar spine for acquisition of images.

Sequences

- Conventional spin echo sequences T1WI, T2WI, STIR sag, T1WI axial, T2WI axial and post contrast T1 axial, sag and coronal.
- **Technique**
- MRI LUMBOSACRAL SPINE was done in all cases on SIEMENS 1.5 TESLA MRI superconducting magnet. Initially non contrast T1 weighted (T1W), T2 weighted (T2W) and short tau inversion recovery (STIR) sequences in axial, sagittal and coronal planes of the involved spine will be taken. Then post-contrast T1 sequence will be obtained by using intravenous administration of gadodiamide (GdDTPA-BMA) of 0.2 mmol/kg doses, in axial, coronal and sagittal planes in selected cases. Several parameters that were noted on MRI are described in performa.

Study Analysis

- A total of 400 patients were included in this study. Informed consent was taken from all the subjects before starting the study. After fulfillment of all the inclusion and exclusion criteria, MR imaging of LUMBOSACRAL SPINE was done by various MR techniques by 1.5-T superconductive scanner (Siemens 1.5T Magnetom aera MRI machine)

Results

Table 1: Spinal canal stenosis

	Number of patients	Percentage
No	210	52.5
Yes	190	47.5
Total	400	100.0

Of the 400 patients evaluated with MRI lumbosacral spine for low backpain, spinal canal stenosis was seen in 190 patients (47.5%).

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Spinal canal stenosis

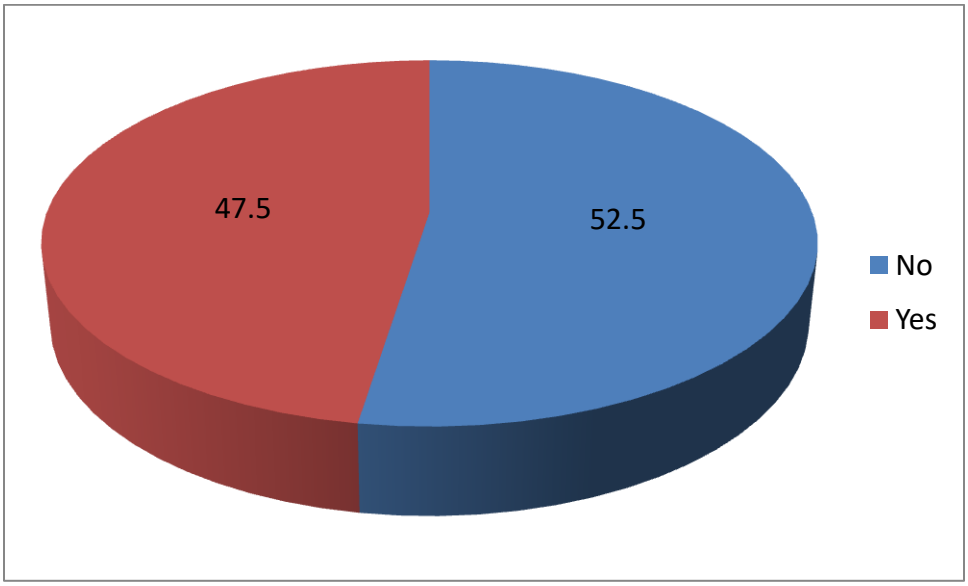

Table 2: Nerve root compression

		Number of patients	Percentage
No		100	25.0
Yes		300	75.0
	L_1-L_2	20	5
	L_2-L_3	40	10
	L_3-L_4	120	30
	L_4-L_5	230	57.5
	L_5-S_1	160	40
	Total	400	100.0

Of the 400 patients evaluated with MRI lumbosacral spine for low back pain, nerve root compression was seen in 300 (75.0%) patients, with maximum number of patients having nerve root compression at L_4-L_5 disc level.

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Nerve root compression

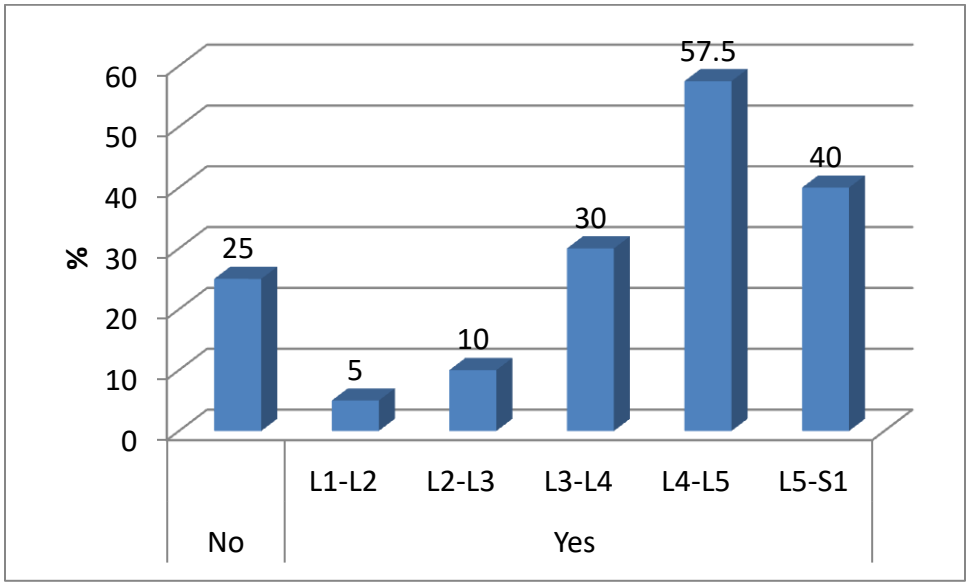

Table 3: Distribution of cord involvement

	Number of patients	Percentage
No	320	80.0
Compressed	30	7.5
Diastematomyelia with hydromyelia and lipomyelocele	10	2.5
Tarlov cyst	10	2.5
Myelomalacia	10	2.5
Split cord,tethered cord	10	2.5
Filar lipoma	10	2.5
Total	400	100.0

Of the various spinal cord pathologies, spinal cord compression was seen in 30 patients (7.5%), diastematomyelia with hydromyelia and lipomyelocele was seen in 10 patients (2.5%), Tarlov cyst was seen in 10 patients (2.5%), myelomalacia was seen in 10 patients (2.5%), split cord with tethered cord was seen in 10 patients (2.5%) and filar lipoma was seen in 10 patients (2.5%). However no cord pathology was seen in 320 patients (80.0%).

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Distribution of cord involvement

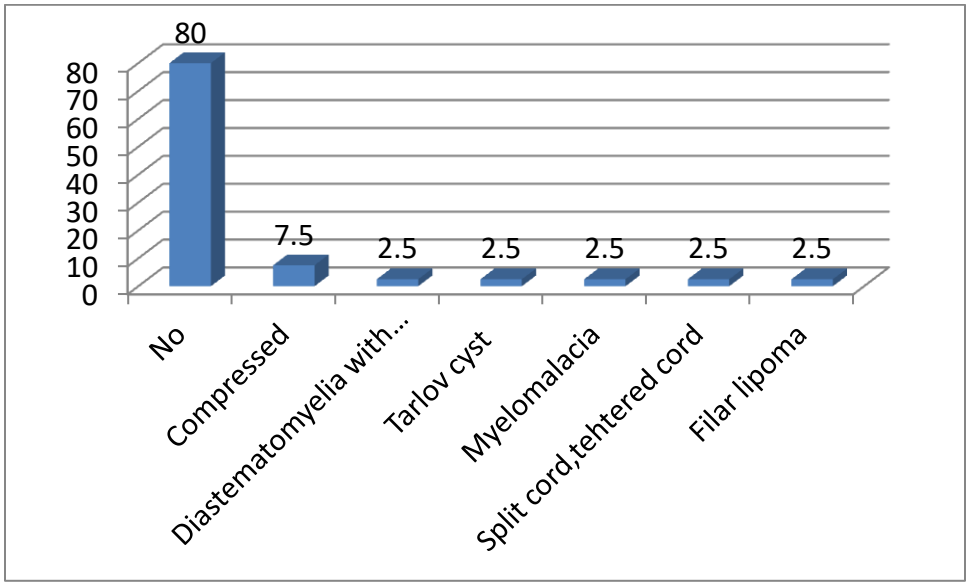

Figure (A) T2 AXIAL Image showing Spinal dysraphism with lipomyelocele at L5 vertebral level.

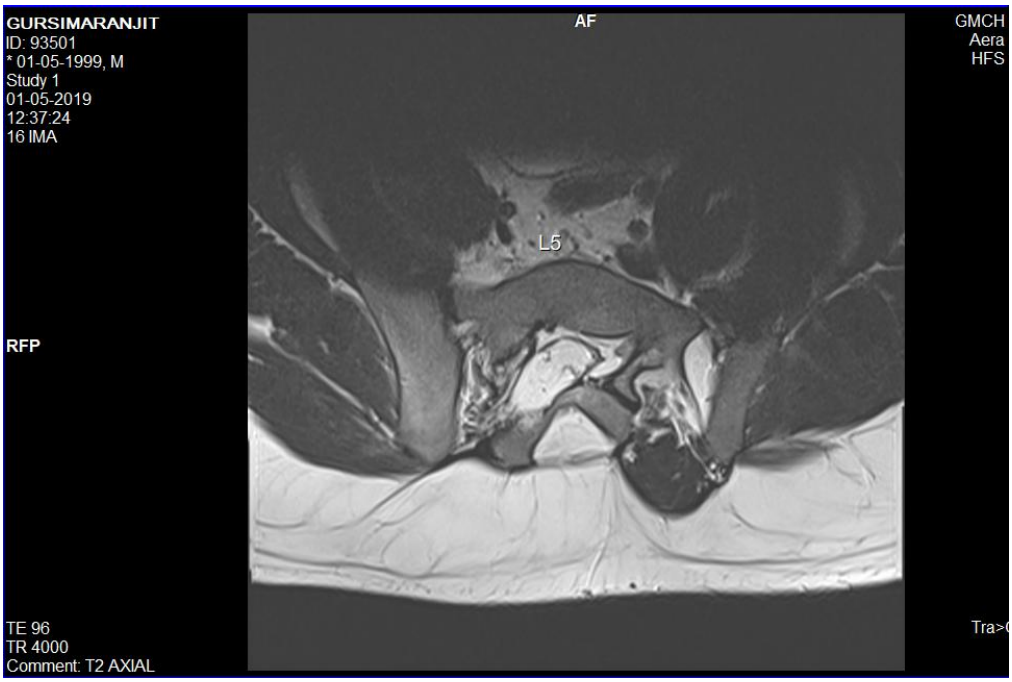

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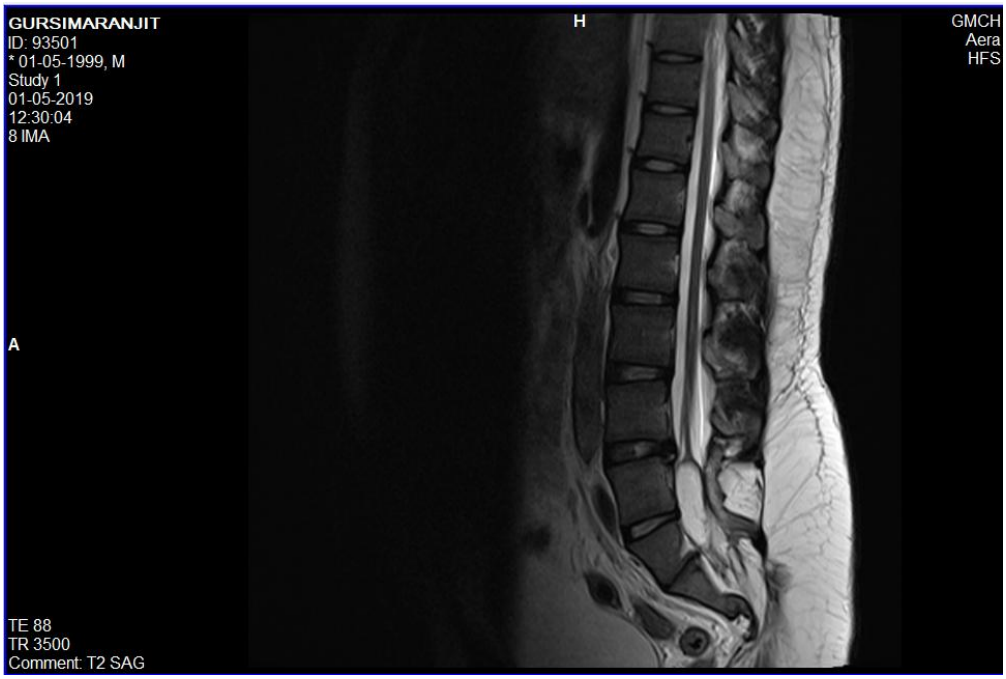
Figure (B) T2 SAG Image showing an intraspinal lipoma with tethered cord.



Discussion

In the present study, out of 400 patients evaluated with MRI lumbosacral spine for low backpain, spinal canal stenosis was seen in 190 patients (47.5%). This is in concordance with the study conducted by Rohini et al[3] (2017) who reported spinal canal stenosis in 63 out of 136 patients (46.3%). In another study conducted by Uzomaka et al[4] (2017) spinal canal stenosis was found in 46.6% of patients with low backpain.

In the present study, out of 400 patients evaluated with MRI lumbosacral spine for low backpain, nerve root compression was seen in 300 (75.0%) patients, with maximum number of patients having nerve root compression at L_4-L_5 disc level. %). This is in concordance with the study conducted by Rohini et al[3] (2017) who reported nerve root compression in 103 out of 136 patients (75.7%). In another study conducted by Kohat et al[5] (2017) disc dessication was found in 52 patients out of 72 patients (72.5%) with low back pain and was most common at L4-L5 level as compared to other levels. The results are also comparable to the study conducted by Suthar Pukhraj et al[6] (2015) who concluded that narrowing of lateral recess and compression of neural foramen were seen in 127 discs (i.e. 52.70% of disc involvement) and both were common at L4 –L5 disc 60(i.e. 47.24% of involvement).

In the present study, of the various spinal cord pathologies, spinal cord compression was seen in 30 patients (7.5%), diastematomyelia with hydromyelia and lipomyelocele was seen in 10 patients (2.5%), tarlov cyst was seen in 10 patients (2.5%), myelomalacia was seen in 10 patients (2.5%), split cord with tethered cord was seen in 10 patients (2.5%) and filar lipoma was seen in 10 patients (2.5%). However no cord pathology was seen in 320 patients (80.0%). In the study done by Mustapha Z et al[7] (2013) cord compression was seen in 8 patients (1.44%) and cord transection was seen in only 1 patient .

Conclusion

Based on the results of our study the following conclusions can be made:

Of the 400 patients evaluated with MRI lumbosacral spine for low backpain, spinal canal stenosis was seen in 190 patients (47.5%).

Of the 400 patients evaluated with MRI lumbosacral spine for low back pain, nerve root compression was seen in 300 (75.0%) patients, with maximum number of patients having nerve root compression at L_4-L_5 disc level.

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Thus MRI is a useful and safe modality for the evaluation of lumbar vertebral pathologies involving spinal canal stenosis and nerve root compression.

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