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Evaluating the causes of compressive myelopathy by MRI in PMCH, Patna

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ABSTRACT

Background: Compressive myelopathy is a broad term that refers to spinal cord involvement of multiple etiologies. It is the term used to describe the spinal cord compression either from outside or within the cord itself. In contrast to plain radiograph MRI is considered a better imaging modality to assess soft tissue of spine and spinal cord abnormalities like traumatic myelopathy, spinal tumors and spinal infections. Many of these diseases are potentially reversible if they are recognized on time. Hence the importance of recognizing the significance of MRI lies on an early and accurate diagnosis. Keeping this in view, study was aimed to evaluate the causes of compressive myelopathy with their characterization by MRI.
Materials and Methods: A descriptive hospital-based study was conducted by purposive sampling. Fifty clinically suspected cases of compressive myelopathy were investigated with MRI.
Results: Most common cause for compressive myelopathy in our study was spinal trauma (50%) followed by spinal infection (28%). Extradural compressive lesions (90%) were the most common cause for compressive myelopathy. MRI detected cord changes in 88% of cases with cord compression and also assessed the integrity of spinal cord, intervertebral discs and ligament after acute spinal trauma.
Conclusion: Patients with suspected Compressive myelopathies could be benefited with evaluation by MRI, as it is highly accurate and sensitive non-invasive modality for characterizing and identifying the underlying etiology, as well as associated features. Thus, helps in stating the long-term prognosis of the patient.

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1. Introduction

The term myelopathy describes pathologic conditions that cause spinal cord, meningeal or perimeningeal space damage or dysfunction. Thus, myelopathy is a broad term that refers to spinal cord involvement of multiple etiologies and can be divided into compressive and non-compressive. Compressive diseases of the spinal cord are divided into acute and chronic, including degenerative changes, trauma, tumor infiltration, vascular malformations, infections with abscess formation.[1]

Spinal cord diseases often have devastating consequences, ranging from quadriplegia and paraplegia to severe sensory deficits. Many of these diseases are potentially reversible if recognized and treated at an early stage. Thus, they are among the most critical neurologic emergencies, where prognosis depends on an early and accurate diagnosis.[1]

In comparison with CT, MRI detects more traumatic disc herniations, epidural haematomas and spinal cord abnormality, though it is less sensitive in the detection of posterior element fractures. Now a days MR imaging has replaced CT in noninvasive evaluation of patients with painful myelopathy because of superior soft tissue resolution and multiplanar capability and hence can depicts the spinal cord directly, assesses its contour and internal signal intensity characteristics reliably and early.[2]

The present study highlights the various causes of compressive myelopathy and their characteristics evaluated by MRI with their distribution in demographic attributes of suspected cases.

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2. Materials and Methods

After getting approval from the ethical committee of Patna Medical college, a descriptive hospital-based study was conducted in department of Radiology, Patna Medical College & Hospital, Patna for the duration of 18 months from February 2018 to August 2019.

2.1. Operational definition

For the purpose of this study Compressive myelopathy is conceptualized as the spinal cord compression either from outside or within the cord itself, excluding degenerative disc herniation.

By prospective sampling total 50 cases who attended / referred to the department with clinical suspicion of compressive myelopathy were selected.

2.2. Inclusion criteria

1. All age groups.
2. Both sexes.
3. All symptomatic cases of compressive myelopathy.

2.3. Exclusion criteria

1. Cases of non – compressive myelopathy.
2. Degenerative disc herniation.
3. Cases with contraindication for MRI, like prosthetic heart valve, cochlear implant or any other orthopedic metallic implant.

All the cases were subjected to MRI examination using GE SIGNA EXPLORER 1.5 Tesla MR imaging unit. Standard surface coils and body coils were used for cervical, thoracic and lumbar spine for acquisition of images. Conventional spin echo sequences T1WI, T2WI, FLAIR Sag, STIR sag, T1WI, T2WI axial and GRE axial, and post contrast T2WI axial, Sag and coronal were done with with a FOV: Sagittal: 30cm, Axial: 18cm; Matrix size: 256x 256; Slice thickness: 4.5mm x 5mm; Contrast: Gd– DTPA at a dose of 0.1 mmol/kg body wt. If contrast was required, T1W fat saturated pre-contrast images (axial & sagittal) and T1W fat saturated post contrast (axial, sagittal & coronal) images were acquired in addition to routine sequences.

Thus, obtained data were coded and entered into SPSS version 20.0 (trial) and analyzed further.

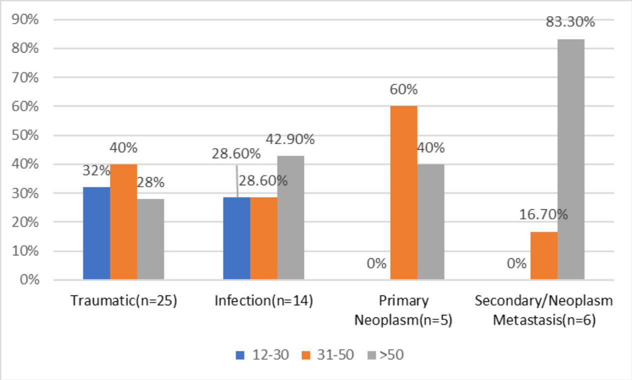
3. Result & Discussion

Among 50 cases, most common cause for compressive myelopathy in our study was spinal trauma (50%) followed by spinal infection (28%) [Table 1]. This finding is in coherence with the finding of Kulkarni et al (1987).[3]

Majority of cases in this present study with post-traumatic myelopathy and primary neoplasms were young adults/ middle age group (31-50 years). While patients with

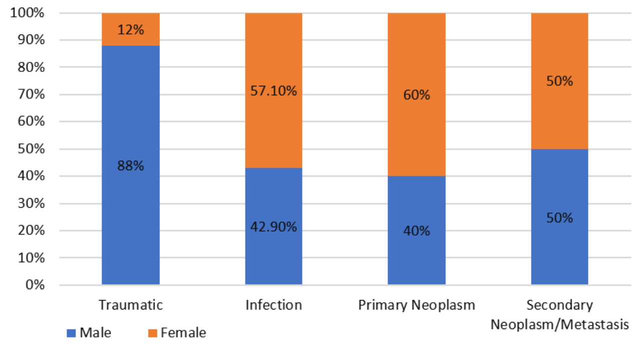
Table 1: Causes of compressive myelopathy

MR diagnosis	Number of patients (n=50)	%
Traumatic Myelopathy	25	50
Infection/TB	14	28
Primary neoplasm	5	10
Secondary Neoplasm/Metastases	6	12



Graph 1: Age wise distribution of compressive lesions

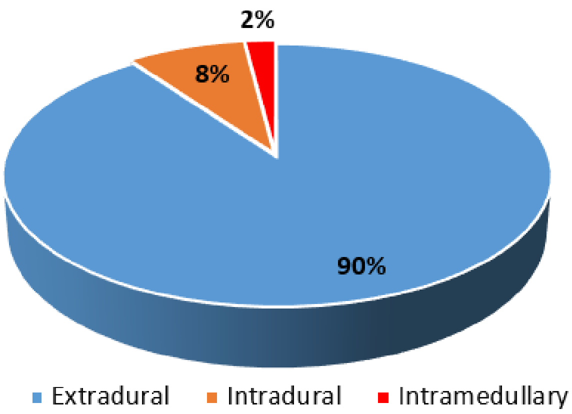
infection and metastases belonged to older age group (>50 years). This is in an agreement with the study of Granados A et al. (2011)[1] & Yukawa et al(2007)[4] [Graph 1].



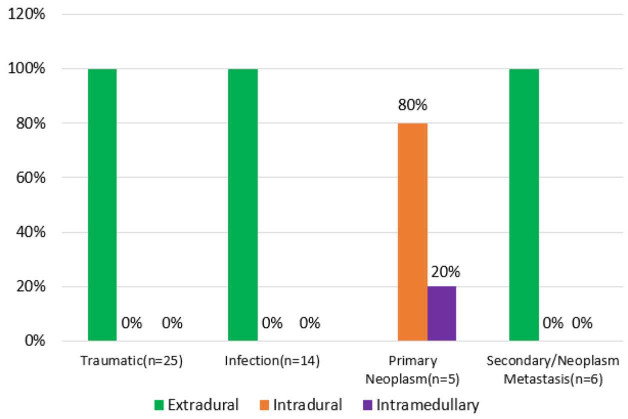
Graph 2: Gender wise distribution of Compressive lesion

In this study most of the spinal injury (88%) occur in male population while spinal infection/TB (57.1%), primary neoplasms (60%) were more common in female population while secondary neoplasms were seen equally in both the gender [Graph 2]. This is in comparison to the study conducted by Yang R et al. (2014).[5]

Graphs 3 and 4 depict trauma & infectious spondylitis were common causes for extradural compression while primary neoplasms were more common in intradural extramedullary compartment in our study. However, one case of primary neoplasm was in intramedullary



Graph 3: Location of pathology



Graph 4: Compartmental division of various etiologies ofcompressive myelopathy

compartment.

Table 2: Level of spinal injury

Level of lesion	Number of patients(n=25)	%*
Cervical (C)	15	60
Thoracic(T)	11	44
Thoraco – Lumbar (TL)	0	0
Lumbar(L)	2	8

*Cumulative percentage more than 100 as injury involve more than one spinal level

It is obvious from Table 2 that in spinal injuries, the common site involved was the cervical followed by thoracic region probably due to more cases of vehicular accident which is in coherence with the study of Granados A et al. (2011)[1] while in contrast with the findings of the study done by Kulkarni et al.[3]

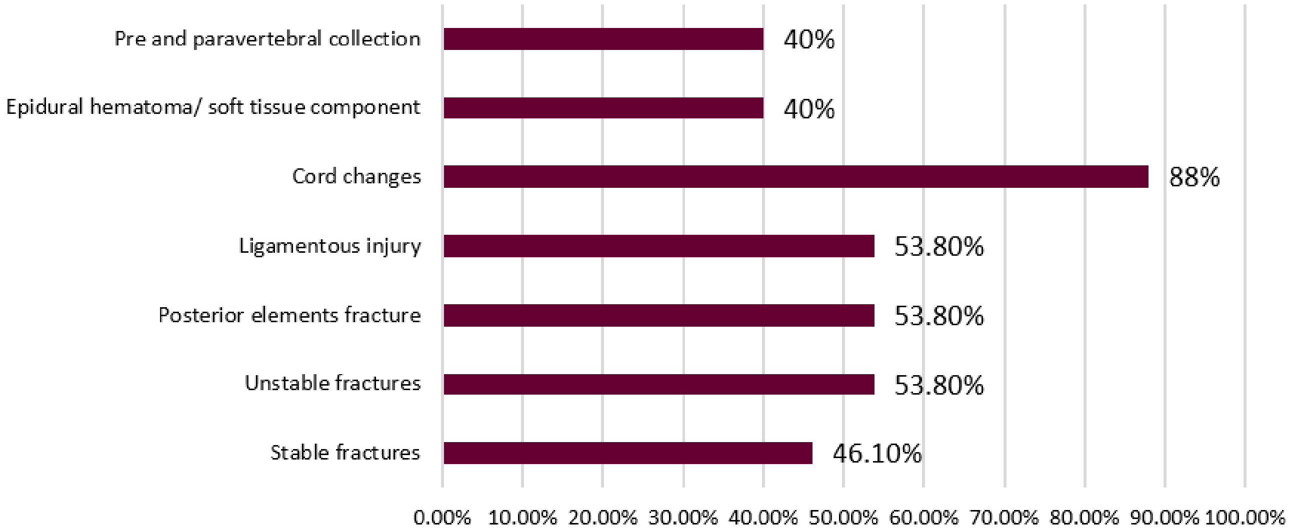
MRI depicts spinal cord changes (high signal intensity on T2WI and STIR sequence) along with the relationship of subluxed / dislocated vertebral bodies to the cord, posterior elements fracture, ligamentous disruption, hematoma & soft tissue injuries (high signal on STIR). All these have prognostic implication and can be used to classify injury into stable / unstable [Figures 1 and 2]. Findings of this current study is in agreement with the study of Kulkarni et al.(1987), Dundamadappa SK (2012),[6] Flanders et al(1997)[7] & warner J et al. (1996)[8] which indicate advantage of MRI in demonstrating all these changes[Graph 5].

Fig. 1: Pre and paravertebral collection with ALL and PLL disruption with severe cord compression and extensive edema

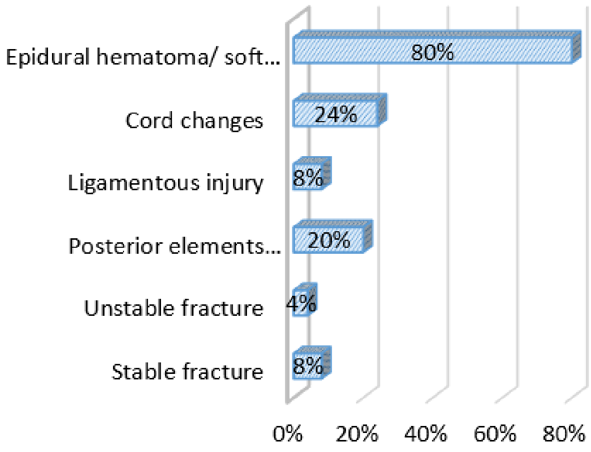
Fig. 2: Odontoid fracture with atlantoaxial subluxation, ligamentous injury with an increased ADI, cord edema and compression

In non-traumatic causes of spinal cord compression epidural soft tissue component is seen in 20 patients (80%) cord changes are seen in 6 patients (24%), pre and paravertebral collection in 13 patients (52%) Ligamentous disruption in 2 patients (8%) posterior elements abnormality in 5 patients (20%) stable fractures in 2 patients (8%) unstable fractures in 1 patients (4%)[Graph 6]. MRI in infective spondylitis showed epidural component as hypointense on T1WI, hyperintense on T2WI and FLAIR images and rim enhancement around the intra–osseous and paraspinal soft tissues abscess[Figure 3].

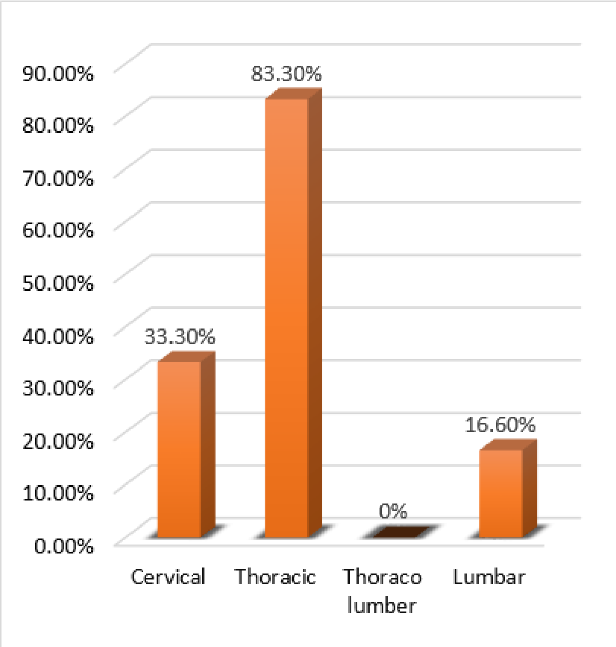
Out of 6 patients, 5 (83.3%) showed more than one lesions. This is in comparison to study done by Lien et al.



Graph 5: Characterization of spinal injuries by MRI



Graph 6: Characterization of Non – Traumatic spinal compression by MRI



Graph 7: Site of Metastasis

in which 78% had more the one lesions. In our study most common site of involvement(metastasis) was the thoracic spine (83.3%). This is in comparison to the study done by Livingston et al.[9] where site of epidural tumor in thoracic spine was 68%. We used T1WI, T2WI and STIR sequence to image spinal metastases. T1WI was useful in the detection of bone marrow metastases and STIR helped in picking up more marrow lesions[Graph 7][Figure 4].

Primary neoplasms (80%) were common in the intradural extramedullary compartment in this study[Table 3]. In our study, there were 5 cases of primary neoplasm out of which 2 cases were neurofibroma, 2 cases meningioma and rest one case was of ependymoma. Nerve sheath tumors were iso to hypointense on T_1WI and hyperintense

Table 3: Primary neoplasms and their compartmental distribution

Primary neoplasm (5)	**No. of patients**
Meningioma	02
Neurofibroma	02
ependymoma	01
Primary neoplasm (5)	**No. of patients**
Intradural - extramedullary	4(80%)
Intramedullary	1(20%)

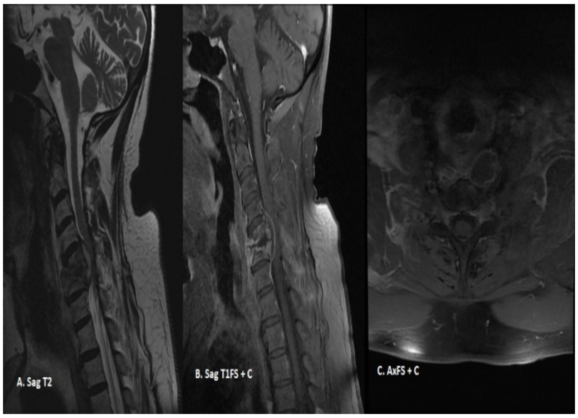


Fig. 3: Cervical spine demonstrating tuberculous spondylodiscitis causing cord compression with cold abscess and epidural abscess

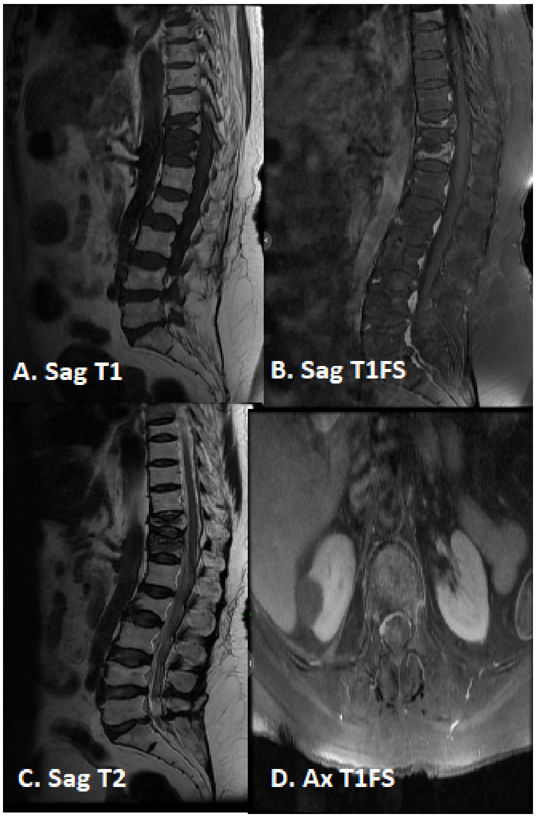


Fig. 4: Sclerotic metastasis – Ca Prostrate

on T_2WI and showed intense heterogeneous enhancement on post contrast. Out two cases of nerve sheath tumour one was plexiform neurofibromatosis which demonstrated hypointense central focus (target sign) on T2WI [Figure 5] and another was neurofibroma showed extension into neural foramina [Figure 6]. Similar findings can be observed in studies done by Dorsi et al and Matsumo et al.[10] Meningioma showed isointensity on T_1 & T_2WI. On postcontrast study it showed homogenous enhancement which was coherent with the studies done by Matsumoto et al., Genzen et al.[11] and Saweidane et al.[12] In our study ependymoma which was in cervical region, showed T_1iso to hypointensity & T_2 iso to hyperintensity. A hypointense hemosiderin rim (cap sign) on T_2 weighted images was also observed. Similar finding can be seen in study done by Kahan et al.[13]

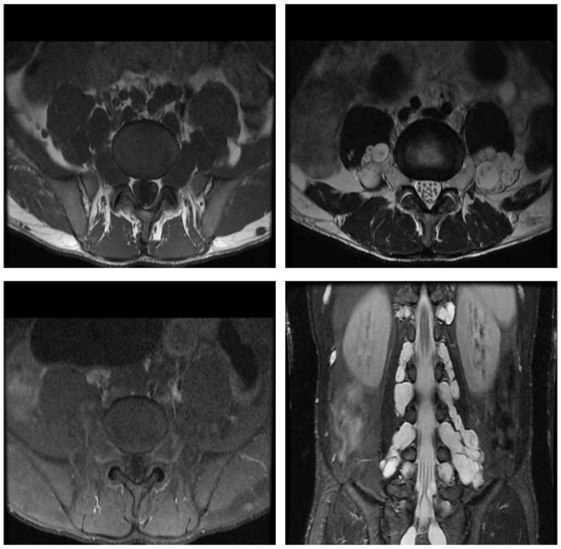


Fig. 5: Multiple neurofibroma in the spinal canal, in the neural foramina and paravertrebral region bilaterally

4. Conclusion & Recommendation

MR imaging depicts the spinal cord directly, assesses its contour and internal signal intensity characteristics reliably and noninvasively so we can evaluate associated cord oedema or contusion and also the integrity & early changes in intervertebral discs and ligaments which can be crucial in long term prognosis of the patient. So, it makes MRI, an essential modality in assessing soft tissues of the spine and spinal cord abnormalities. Thus, MRI is very sensitive imaging modality to detect, characterize, determine the extent of various Spinal tumours and infections. So, we can conclude that MRI is definitive, accurate, though costly but non-invasive, radiation free modality for evaluation of Compressive myelopathy.

Further study could be established to emphasize the role of MRI in determining the severity of cord compression and in evaluating the prognosis. This could be more helpful to determine surgical intervention of needed patients. It can also play a valuable role in triage during disaster, particularly when looking at the patient overload with respect to the patient and infrastructure/resource ratio at our hospitals in India.

Due to lack of quantitative assessment of signal changes in MRI sequences, combination of MRI and 18 F-FDG-PET

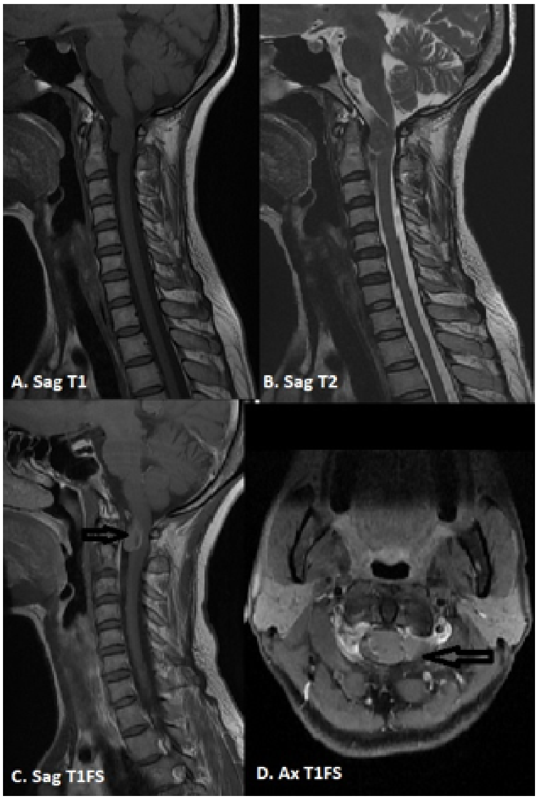


Fig. 6: Intradural extramedullary neurofibroma in cervical spine with extension into neural foramina

could be done as future research to uncover more features of compressive myelopathy with respect to prognosis.

5. Limitations of Study

1. The results cannot be generalized to the whole population of compressive myelopathy.
2. Surgical correlation and histopathological correlation for all cases could not be done.

6. Abbreviation

ALL (Anterior longitudinal ligament), PLL (Posterior longitudinal ligament), (ADI) atlantodens interval.

7. Source of Funding

Nil.

8. Conflict of Interests

None.

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