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ROLE OF MAGNETIC RESONANCE IMAGING IN EVALUATION OF COMPRESSIVE MYELOPATHY IN DEPARTMENT OF RADIODIAGNOSIS

Radio-Diagnosis

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ABSTRACT

Background: Myelopathy involves neurological impairments caused by spinal cord compression due to various factors including osteophytes, disc herniation, trauma, and metastatic cancer. Accurate diagnosis and characterization of the underlying pathology are essential for effective management. **Objective:** This study evaluates the role of MRI in assessing compressive myelopathy, identifying its causes, and classifying spinal pathologies based on their location within the spinal compartments. **Methods:** This cross-sectional observational study was conducted at SMS Hospital, Jaipur. Seventy patients with symptomatic compressive myelopathy underwent MRI using a 3T GE machine. **Results:** The average age of patients was 39.33 years. The most common causes of compressive myelopathy were degenerative (35.71%), traumatic (31.4%), infectious (21.42%), and neoplastic (11.42%). Degenerative conditions were predominant in those over 50 years, while traumatic cases were more common in the 31–50-year age group. The majority of pathologies were found in the extradural compartment (94.28%), with cervical spinal levels being the most frequently affected (50%). MRI revealed spinal cord abnormalities, including cord compression, epidural hematoma, and other lesions. MRI effectively detected various spinal tumors and infections, consistent with previous studies. **Conclusion:** MRI provides comprehensive, non-invasive imaging of spinal cord compression, essential for diagnosing and characterizing myelopathy. Its high sensitivity and detailed imaging capabilities make it a valuable tool for evaluating spinal tumors and other pathologies, ensuring accurate diagnosis and management.

KEYWORDS

Compressive myelopathy, Trauma, Cancer, MRI

INTRODUCTION

Myelopathy refers to neurological impairments caused by spinal cord compression, which can occur either externally or internally. The most common cause of myelopathy is compression of the spinal cord in the cervical spine due to osteophytes or extruded disc material. Less commonly, myelopathy can result from osteophytic spurring and disc herniation in the thoracic spine.[1] other cause include acute or penetrating trauma and compression from extradural masses, often due to metastatic cancer. The spinal cord may also be compressed by benign neoplasms and cysts, most of which are intradural, with meningiomas, nerve sheath tumors, arachnoid cysts, and epidermoid cysts being the most frequent. [1]

The diagnosis of spinal cord injury is typically guided by the patient's history, a thorough neurological examination, and cerebrospinal fluid (CSF) analysis. However, imaging is crucial for narrowing down the diagnosis and properly categorizing the etiology.[2]

In elderly patients, myelopathy is often due to chronic, non-recurrent conditions. T2-weighted MRI images typically show high-intensity signals from myelomalacia, gliosis, tethering injuries, vascular or inflammatory edema, demyelination, and vascular changes.[3] Gadolinium enhancement generally highlights the area of greatest compression. Unlike inflammatory myelopathies, which improve with corticosteroids, compressive myelopathy does not. MRI is preferred over plain radiographs for assessing spinal injuries, as it effectively differentiates between spinal cord hemorrhage and edema, offering crucial prognostic information.[4]

In cases of spinal trauma, MRI can reveal severe stenosis and show the relationship between fractured or subluxated vertebral bodies and the cord. MRI can also identify signal abnormalities within the cord, helping to define and localize the extent of trauma. Additionally, MRI is highly effective in imaging tumors involving the spinal column, canal, and cord, particularly when tumor-induced cord compression is suspected.[5]

This study aims to assess the role of magnetic resonance imaging (MRI) in evaluating compressive myelopathy and its various causes, characterizing different spinal cord compressive pathologies, classifying these pathologies based on their location within the extra/intradural compartment, and identifying the spinal cord level most frequently involved.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at SMS Hospital, Jaipur, involving the Departments of Radiodiagnosis, Neurology, Medicine, and Neurosurgery. Patients meeting the inclusion criteria (all age groups, symptomatic compressive myelopathy) were selected, while those with non-compressive myelopathy, MRI contraindications, claustrophobia, or who had previously undergone surgery were excluded. Data collected included demographic details, symptoms, physical findings, and MRI results. MRI sequences included sagittal and axial T1 and T2-weighted images, STIR, T2WI GRE, DWI, and 3D CISS. Contrast was used for tumours, infections, or post-operative cases.

RESULTS & DISCUSSION:

In our study, the average age of patients diagnosed with compressive myelopathy was 39.33 years. Among them, the majority fell into two age groups: 41.4% (n=29) were over 50 years old and 40% (n=28) were aged between 31 and 50 years. Increased T2W signals in the spinal cord can indicate degenerative changes, trauma, vascular malformations, tumors, etc. Age-related changes like disc bulges, disc protrusions/herniation, and end plate osteophytes can lead to spinal cord compression. The most prevalent pathology was found in the extradural compartment, accounting for 94.28%, followed by 2.85% each in the intradural and intramedullary compartments.

Table.1 Baseline characteristics of study subjects

Variables	No. of patients	%
Age group		
12-30	13	18.57
31-50	28	40
>50	29	41.4
Gender		
Male	31	44.28
Female	39	55.71
Causes of compressive myelopathy on MRI		
Degenerative	25	**35.71**
Traumatic	22	**31.4**
Infection	15	**21.42**
Neoplasm	8	**11.42**
Location of pathology		
Extradural	66	94.28
Intradural	2	2.85
Intramedullary	2	2.85

In our investigation, degenerative causes, traumatic injuries, and infections were identified as the most common reasons for extradural compression. In terms of spinal injury location, the cervical level was the most common, observed in 50% of patients in our study. Thoracic level injuries were present in 45.45% of cases, while lumbar level injuries were much less frequent, occurring in only 4.54% of cases.

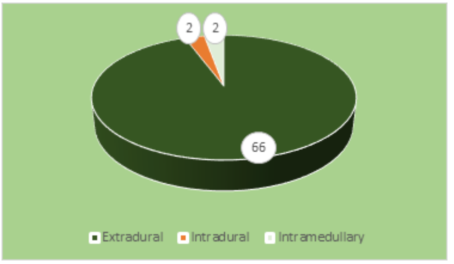

Fig1 Location of pathology

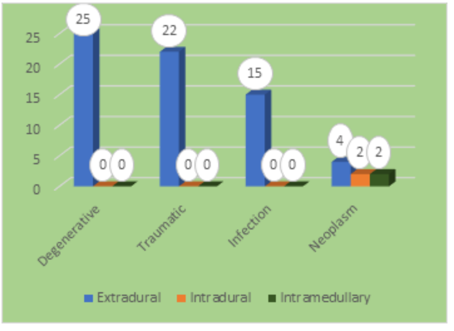

Fig.2 Causes of compartment

The MRI revealed spinal cord abnormalities, including cord compression and abnormal signal intensities within the spinal cord. In 18.57% of cases, spinal cord compression with associated injury was evident, characterized by hypo-intensity on T1WI and hyperintensity on T2WI and fluid attenuation inversion recovery (FLAIR) images, indicative of cord edema or contusion. These signal changes were inconsistent with previous studies by **Agarwal M et al (2017)**[7] **and Hackney et al (1986)**[8]

The predominant MRI findings resulting from non-traumatic spinal compression were cord changes, detected in 44.28% of cases, followed by diffuse disc bulge and hypertrophy of the ligamentum flavum, present in 35.74% of cases. Irregular end plate enhancement and collections in the pre and paravertebral areas were observed in 21.42% of cases. Additionally, a small percentage of cases (2.85%) exhibited broad-based masses with avid enhancement, soft tissue around the nerve with few cystic changes, and soft tissue enhancing masses encasing the nerve (Table.2). Other findings in our patients, such as epidural hematoma in 14.28% of cases, pre and paravertebral collections in 12.85% of cases, ligamentous injuries in 8.57% of cases, diffuse disc bulging in 7.14% of cases, and posterior element fractures in 5.71% of cases.

Table 2 MRI findings

MRI findings	No. of patients	%
Broad based mass with avid enhancement	2	2.85
Diffuse disc bulge	25	35.74
Cord changes	31	44.28
Ligamentum flavum hypertrophy	25	35.74
Disc osteophyte	3	4.28
Irregular end plate enhancement	15	21.42
Pre and paravertebral collection	15	21.42
Soft tissue around the nerve with few cystic changes	2	2.85
Soft tissue enhancing mass encasing the nerve	2	2.85
Dural tail sign + broad based mass with avid enhancement	1	1.42

In our study of 8 cases of neoplasms, we categorized 4 as secondary neoplasms and 4 as primary neoplasms. Among these, neurofibroma was identified in 2 cases, characterized by nerve sheath tumors displaying iso to hypo-intensity on T1-weighted images (T1WI) and hyperintensity on T2-weighted images (T2WI) (Table 3), with intense heterogeneous enhancement on post-contrast images.

Table 3 Primary neoplasms and secondary neoplasm with their compartmental distribution

Neoplasm	No. of patients	%
Primary neoplasm (n=4)		
Meningioma	1	25
Neurofibroma	2	50
Schwannoma	1	25
Primary Neoplasm (n=4)		
Intradural-extramedullary	2	50
Intramedullary	2	50
Secondary neoplasm (n=4)		
Extradural	4	100

In our analysis of 70 cases, 4 (5.71%) were attributed to metastatic spinal disease-causing compressive myelopathy. In all four patients, intraspinal extradural masses causing cord compression originated from abnormal areas of the vertebra, a finding supported by a study conducted by **Lien et al (1990)**[9] where 90% of cases showed extradural masses extending from abnormal vertebrae.

Among the four cases of secondary neoplasms, metastasis occurred in the thoracic region in 75% of cases and in the lumbar region in 25% of cases. This contrasts with a study by **Livingston KE et al.** [10] where the site of epidural tumor in the thoracic spine was reported to be 68%.

Metastases to the spine can involve the bone, epidural space, leptomeninges, and spinal cord. The spine is the third most common site for metastatic disease, following the lung and the liver and the most common osseous site. In our study we had 1 patient with primary carcinoma bronchus, 1 patient had breast carcinoma, 1carcinoma prostate, and 1patients lymphoma. We utilized T1-weighted imaging (T1WI), T2-weighted imaging (T2WI), and Short-TI Inversion Recovery (STIR) sequences, along with post-contrast imaging, to visualize spinal metastases. T1WI proved effective in detecting bone marrow metastases, while STIR aided in identifying additional marrow lesions.

CONCLUSION

MRI imaging provides a direct depiction of the spinal cord, enabling reliable and non- invasive assessment of its contour and internal signal intensity characteristics. This allows for the evaluation of associated cord edema or contusion, as well as the integrity and early changes in intervertebral discs and ligaments, which are crucial for the long-term prognosis of the patient. Consequently, MRI emerges as an indispensable modality for assessing soft tissues of the spine and abnormalities of the spinal cord. Its high sensitivity enables the detection, characterization, and determination of the extent of various spinal tumors and infections. Therefore, we can affirm that MRI is a definitive, accurate, albeit costly, non-invasive, and radiation-free modality for evaluating compressive myelopathy.

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