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Role of MRI in Evaluation of Patients Clinically Diagnosed Non-Traumatic Myelopathy

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KEYWORDS

Magnetic Resonance Imaging, Non-Traumatic Myelopathy, Diagnosis and Neuroimaging

ABSTRACT:

Introduction: Any neurological deficiency arising from injury or malfunction of the spinal cord, whether it be sensory, motor, or autonomic, is referred to as myelopathy. Myelopathy can be caused by a wide range of illnesses. These diseases can have a variety of etiologies, including infections, inflammatory, neoplastic, vascular, degenerative, or deficient disorders.

Aims: MRI characterization of spinal cord lesion and correlated them with clinical findings. To classify compressive and non-compressive nature of the lesion based on MRI.

Materials and method: The present study involved 50 patients having non traumatic, in the Department of Radiodiagnosis and Imaging, of BMCH over a period from October 2020 to December 2021.

Result: In this study of 19 cases of non-compressive myelopathy are found. Etiology of these cases were Acute transverse myelitis (post-infective) (47.5 %), Multiple sclerosis (15.8%), Neuromyelitis spectrum disorders (10.5%), Subacute combined degeneration (15.8%), Spinal infarct (5.2%) and post radiation myelitis (5.2%).

Conclusion: We find that the most prevalent cause of compressive myelopathy is spinal TB, while the most common cause of non-compressive myelitis is post-infective acute-transverse myelitis. The amount of spinal cord involvement and the compartments (Extradural, Extramedullary-Intradural, and Intramedullary) of compressive causes of myelopathy are effective means of characterizing them. The degree of spinal cord involvement and short segment or long segment involvement are characteristics of non-compressive causes of myelopathy.

Journal of Chemical Health Risks

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INTRODUCTION

Any neurological deficiency arising from injury or malfunction of the spinal cord, whether it be sensory, motor, or autonomic, is referred to as myelopathy. [1]

Myelopathy can be caused by a wide range of illnesses. These diseases can have a variety of etiologies, including infections, inflammatory, neoplastic, vascular, degenerative, or deficient disorders. [2] The category of diseases known as compressive myelopathy occurs when the spinal cord is squeezed, either internally or externally. Herniated discs, post-traumatic compression from vertebral fracture or dislocation, epidural hemorrhage, epidural abscess, and spinal neoplasms (extradural, extramedullary, intradural, and intramedullary) can all result in compression.

Non- traumatic myelopathies may present as paraparesis /paraplegia, quadriparesis/quadriplegia with or without involvement of bladder and bowel. Paraparesis and quadriparesis is defined as partial loss/weakness of functions in both lower limbs and all four limbs respectively. Bladder and bowel involvement denoted involvement of autonomic functions of spinal cord.

Imaging methods are always preferred for the diagnosis and confirmation of spinal cord diseases since tissue identification of spinal cord illness is sometimes extremely challenging and always entails the risk of harm to neural tissue. CT, MRI, myelography, and plain radiography are examples of imaging modalities. But in the last 20 years, magnetic resonance imaging (MRI) has emerged as the gold standard for diagnosing myelopathy. As a result, current applications of earlier techniques like myelography are restricted to cord contour assessment.[3] Myelography shows thecal sac compression and nerve root takeoff, however it is neither sensitive nor specific.

Without a doubt, magnetic resonance imaging (MRI) has transformed the imaging of myelopathy. MRI is not only more precise in characterizing intrinsic cord illness than CT or myelography, but it is also more sensitive in detecting spinal cord disease. When it comes to accurately diagnosing illnesses of the spine and spinal cord, MRI outperforms CT in a number of ways. In addition to being a non-invasive, radiation-free treatment with great neural element imaging and enhanced accuracy in identifying intrinsic cord illness, magnetic resonance imaging (MRI) also makes 3-dimensional imaging easier and has very few serious adverse effects. [4]

MATERIALS AND METHODS

After the approval of the ethics committee of Burdwan Medical College and Hospital and permission of The West Bengal University of Health sciences, the data for the study is were collected from patients referred to MRI scan at Dept of Radiodiagnosis and Imaging, Burdwan Medical College and Hospital, Burdwan.

Type of Study: An Observational Cross-sectional Study

Study Timeline: 1st October 2020 to 31st December 2021

Place of Study: Department of Radiodiagnosis and Imaging, Burdwan Medical College & Hospital.

Study Population: The study was done on patients clinically diagnosed as paraparesis due to myelopathy referred from the Department of Neurology, Burdwan Medical College and Hospital. They were subjected to MRI spine during the study period that is 1st October 2020 to 30th May 2021 fulfilling the inclusion criteria and excluded by exclusion criteria were selected for the study.

Sample Size: **50 consecutive cases** were selected by a purposive sampling meeting the inclusion and exclusion criteria.

Inclusion Criteria:

- Patients clinically diagnosed as paraparesis due to non-traumatic myelopathy.
- Both Sexes.
- Age >12 years

Exclusion Criteria:

- Patients having diagnosed of traumatic myelopathy;

Journal of Chemical Health Risks

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JCHR (2024) 14(5), 1939-1945 | ISSN:2251-6727

- Any metallic implant which is activated by electric, magnetic or mechanically; e.g. Cardiac pacemakers, cochlear implants, hearing aids, intracranial aneurismal clips, ferromagnetic surgical clips, metal foreign body in the eye, metal shrapnel or bullets.
- Patients with co-morbidities (diabetes mellitus, hypertension, chronic kidney disease), hemodynamically unstable and have respiratory distress, not suitable for MRI examination.
- Patients who do not give valid informed consent.

RESULT

Table 1: Distribution according to Compressive and non-compressive myelopathy

Type of Myelopathy	Frequency	Percentage
Compressive	31	62
Non-compressive	19	38
Total	50	100

Table 2: Causes of compressive myelopathy, Compartment of the causes of compressive myelopathy and Level of spinal cord lesion in compressive myelopathy

	Parameter	Number of patients (n=31)	%
MR diagnosis	Tuberculosis	10	32.2
	Primary neoplasm	5	16.1
	Secondary neoplasm/ metastasis	7	22.6
	Degenerative disease (cervical spondylitis)	7	22.6
	Others	2	6.5
Compartment	Extradural	24	77.4
	Extramedullary-Intradural	5	16.1
	Intramedullary	2	6.5
Level of spinal cord lesion	Cervical	9	29.0
	Cervico-Dorsal	2	6.5
	Upper Dorsal	5	16.1
	Lower dorsal	4	12.9
	Upper and lower Dorsal	9	29.0
	Dorso-lumber	2	6.5

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 1939-1945 | ISSN:2251-6727

Table 3: Sex distribution in various causes of compressive myelopathy

	Male	Female
Tuberculosis (n=10)	6	4
Primary neoplasm (n=5)	2	3
Secondary neoplasm/ metastasis (n=7)	3	4
Cervical spondylotic myelopathy (n=7)	3	4
Dural AVM (n=1)	1	0
Syringohydromyelia (n=1)	1	0

Table 4: Causes of non-compressive myelopathy

Causes	Frequency	%
Acute transverse myelitis	9	47.5
Multiple sclerosis	3	15.8
NMO spectrum disorder	2	10.5
Subacute combined degeneration	3	15.8
Spinal infarct	1	5.2
Post radiation myelitis	1	5.2
Total	19	100

The distribution according to compressive and non-compressive myelopathy. Among the 50 patients 31 (62%) had compressive myelopathy and 19 (38%) had non-compressive myelopathy. In the study 31 cases of compressive myelopathy is found. Tuberculosis is the most common cause of compressive myelopathy (32.2%) followed by metastasis (22.6%) and cervical spondylosis (22.6%) and primary neoplasm (16.1%) and other causes (6.5%). Extradural compressive lesions (77.4%) are most common cause of compressive myelopathy followed by extramedullary-intradural (16.1%) and intramedullary (6.5%) lesions Dorsal cord in most commonly affected with 58% of involvement (including upper dorsal, lower dorsal and both upper and lower dorsal regions) followed by cervical (29%), cervico-dorsal and dorso-lumber cord (6.5% each). Tuberculosis is slightly more common in males and primary and secondary neoplasms and cervical spondylotic myelopathy is slightly more common in females.

In this study of 19 cases of non-compressive myelopathy are found. Etiology of these cases were Acute transverse myelitis (post-infective) (47.5 %), Multiple sclerosis (15.8%), Neuromyelitis spectrum disorders (10.5%), Subacute combined degeneration (15.8%), Spinal infarct (5.2%) and post radiation myelitis (5.2%)

DISCUSSION

The present study involved 50 patients having non traumatic, in the Department of Radiodiagnosis and Imaging, of BMCH over a period from May 2020 to July 2021.

The word "myelopathy" connotes spinal cord disorders. They fall into two general categories: non-compressive and compressive myelopathies. Motor, sensory, autonomic, or a mix of these deficiencies can result from myelopathy, and they can vary from minor spasticity to severe quadriplegia or paraplegia that cause

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 1939-1945 | ISSN:2251-6727

substantial morbidity. Lesions can vary in size from minor to large.[5] Lesions defined as extradural, intradural-extramedullary, and intramedullary can be seen in anatomically compressive myelopathy.[6] Numerous etiologies can cause both compressive and non-compressive myelopathy, according to this study on non-traumatic myelopathy.

Radiation myelopathy, syringomyelia, paraneoplastic syndrome, infections, vascular ischemia, multiple sclerosis, motor neuron disease, vertebral spondylosis, neoplasms, infections, and vitamin B12 deficiency are among the non-compressive and compressive causes of non-traumatic myelopathy. Accurately determining the extent of the lesion and determining its underlying cause depend heavily on imaging. When evaluating myelopathy, magnetic resonance imaging (MRI) is the gold standard. Even non-expansile spinal cord lesions may now be reliably diagnosed because to advancements in imaging technology.[7]

The mean age of our patients was 44.4 years with an approximate male to female ratio of 1:1. Out of these 50 patients we had 31 (62%) cases of compressive myelopathy and 19 (38%) cases of non-compressive myelopathy.

In the study of 31 cases of compressive myelopathy we found various cause of compression. Among these are tuberculosis (10), primary neoplasms (5), secondary neoplasms (7), cervical spondylotic myelopathy (7), Dural arterio-venous fistula (1) and syringohydromyelia (1). In our study 7 cases are of metastatic disease of spine as a cause of compressive myelopathy.

In all seven cases, there were intraspinal extradural masses extending from an aberrant section of the vertebra that produced compression of the cord. A research by Lien et al. [8] supports this, showing that 90% of patients had extradural masses that stretched from an aberrant region of a vertebra. Four (60%) of the seven individuals had multiple lesions. The thoracic spine accounted for 80% of the involvement cases in our investigation. This is in contrast to a research by Livingston et al. [10], which found that 68% of the thoracic spine was the location of an epidural tumor.

Ependymoma was the sole instance of an intramedullary primary spinal tumor. Following the introduction of contrast, it was iso to hypointense in T1WI and hyperintense with substantial heterogeneous enhancement in T2WI. There's also the "cap sign." Characteristics like those reported by Koeller et al [9].

In our study, 10 cases of TB spine were associated with compressive myelopathy. 8 cases were in the thoracic region and 1 each in the dorso-lumbar and cervical region. MRI showed vertebral body destruction 4 cases. Epidural component compressing the cord was seen in all the 10 cases which was hypointense on T1WI, hyperintense on T2WI and FLAIR images. Cord edema was associated with 3 cases. Study by Roos DEA et al [10] showed dorsal and lumbar spine as the most common affected site as in our cases. They showed rim enhancement around the intra – osseous and paraspinal soft tissues abscess.

In elderly adults, compressive myelopathy is frequently caused by seven occurrences of cervical spondylotic myelopathy. A cervical spine MRI shows several cervical spine disk herniations together with significant spinal canal stenosis. On T2WI images, the spinal cord alterations are asymmetric and hyperintense. Ellingson BM et al. also provide a description of these imaging alterations. [11]

1 case of syringohydromyelia is found as causes of compressive myelopathy in our study. It was hyper in T2 sequences and hypo in T1WI and is suppressed in FLAIR sequences similar to CSF. Batnitzky S et al [12] also found similar imaging findings.

In one uncommon instance, a progressive development of paralysis in both lower limbs was the presenting symptom of a Dural Arterio-venous fistula compressing the spinal cord. A posterior cord extradural compression was seen on the MRI. With notable serpiginous intradural extramedullary flow gaps, it was heterogeneously enhanced, hypointense in T1 and hyperintense in T2. Patchy enhancement and serpentine enhancing veins are seen on the cord surface following contrast injection. Morris JM yields comparable results. [13]

In the study of 19 cases of non-compressive myelopathy we found various cause. Among these are Acute transverse myelitis (9), multiple sclerosis (3), subacute combined degeneration (3), NMO spectrum disorder

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(5), 1939-1945 | ISSN:2251-6727

(2), Post radiation myelitis (1) and anterior spinal artery infarct (1). Similar findings were observed by Kayal et al [43] and Singh et al. [14]

Acute transverse myelitis was the most often reported cause of non-traumatic myelopathy. Nine cases of acute transverse myelitis were found among the total 19 cases of non-compressive myelopathy. There were three females and six males among them. displaying the supremacy of men. Most of the people participating were in their early and middle years. Three patients showed short segment involvement and six patients showed long segment hyperintensity on T2W images involving several segments. The lesion is centrally positioned and involves more than half of the cord's cross-sectional area, according to axial imaging. Prabhakar et al. [15] describe similar findings.

Out of 19 cases 3 were diagnosed as multiple sclerosis. The diagnosis was done basis of clinical and imaging features. All the patients showed short segment hyperintensity in the T2W images with patchy enhancement. On axial sections the changes of spinal cord are located eccentrically and involves < ½ of the cross-sectional area of the cord as described by Tartaglino LM et al. [16] MRI of brain is also done in suspected case which showed characteristic Dawson fingers involving pericallosal areas perpendicular to corpus callosum 2 cases of NMO are also diagnosed by clinical findings and the long segment involvement of central spinal cord as evidenced by longitudinally extensive T2 hyperintensity. CSF findings of positive AQP-IgG4 helped to confirm the diagnosis later.

Subacute combine degeneration or vitamin B12 deficiency was found to be an important cause of non-compressive myelopathy which was established in 3 patients. Long segment changes in the spinal cord were seen in all of the 3 cases with involvement of posterior column predominantly cervicodorsal cord as mentioned by Ropper AH et al [17]. Serum Vit B12 assay helped to confirm the cases.We had a case of radiation myelitis as cause of non-compressive myelopathy. It was a 67 years old male who had gone for radiation therapy for nasopharyngeal carcinoma 7 years back. MRI showed T1 hypo-intensity and corresponding T2 hyperintensity of the lesions involving long segment of the spinal cord. Imaging features were similar to as describe by Wang PY et al [18].

CONCLUSION

We find that the most prevalent cause of compressive myelopathy is spinal TB, while the most common cause of non-compressive myelitis is post-infective acute-transverse myelitis. The amount of spinal cord involvement and the compartments (Extradural, Extramedullary-Intradural, and Intramedullary) of compressive causes of myelopathy are effective means of characterizing them. The degree of spinal cord involvement and short segment or long segment involvement are characteristics of non-compressive causes of myelopathy. As a result, MRI is a very conclusive, sensitive, specific, and precise imaging modality that doesn't involve intrusive procedures or the risk of ionizing radiation.

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Journal of Chemical Health Risks

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