Research Article

An evaluation of etiological and radiological profile of patients of non-compressive myelopathy in a neurological institute of Eastern India

Rohini Singh[1], Nikhil Prasun[2], Shamshad Ahmad[3]

[1]Department of Radiodiagnosis, ESI-PGIMSR and ESIC Medical College, Kolkata, West Bengal, India, [2]Consultant Neurologist, AMRI Hospital, Kolkata, West Bengal, India, [3]Department of Community Medicine ESI-PGIMSR and ESIC Medical College, Kolkata, West Bengal, India

Correspondence to: Nikhil Prasun, E-mail: nikhil.prasun@gmail.com

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ABSTRACT

Background: Non-compressive myelopathy (NCM) has a wide temporal and clinical profile and etiology that varies over different geographical locations. It constitutes a sizeable proportion of cases admitted in medicine and neurology ward. The etiology may vary according to age, geographical location, food habits, and other associated factors. There remains a great deal of heterogeneity in clinical features and imaging findings. **Objectives:** To evaluate etiological and radiological correlation in diagnosed cases of NCM. **Material and Methods:** This study was conducted in 73 patients of NCM admitted in Bangur Institute of Neuroscience, Kolkata, between August 2009 and 2012. The patients were evaluated clinically, and relevant laboratory, electrophysiological and radiological investigations were conducted. **Results:** In the 73 patients (M:F: 50:23) evaluated, the mean age was 32 years (range 16-48 years). Etiology was established in 66 (90.4%) cases and these are acute transverse myelitis (ATM) (post infectious) in 30 (41.1%); multiple sclerosis (MS) in 10 (13.7%); Vitamin B12 deficiency in 9 (12.3%); tubercular myelitis in 6 (8.2%); neuromyelitis optica (NMO) in 4 (5.5%), sarcoidosis in 3 (4%), vascular in 1 (1.3%); hereditary spastic paraplegia in 1 (1.3%); post-radiation myelitis in 1 (1.3%), and post lightening myelitis in 1 (1.3%). **Conclusions:** Post-infectious ATM is the most common cause of NCM followed by MS. Vitamin B12 deficiency is the third common cause of myelopathy prevalent in predominantly in vegetarian community. Acute tubercular myelitis has been found to be an important cause of NCM in this region.

KEY WORDS: Transverse Myelitis; Multiple Sclerosis; Magnetic Resonance Imaging

INTRODUCTION

Acute non-compressive myelopathies include heterogeneous conditions that result in spinal cord dysfunction. Dysfunction of ascending and descending axons and local neural circuits is reflected by various myelopathic signs and symptoms. Disease spectrum ranged from demyelination, infection, nutritional, toxic, and heredo-familial to degenerative conditions.[1] As compared to Western Countries this spectrum varied in India. Magnetic resonance imaging (MRI) is a very sensitive diagnostic modality for the intramedullary spinal lesions. It is due to a great deal of heterogeneity; the clinicians and neurologists have often felt the need to establish a tangible correlation between clinical presentation and a wide spectrum of MRI findings. MRI is a very sensitive diagnostic modality for the intramedullary spinal lesions. Acute transverse myelitis (ATM) is an enigmatic entity with acute or subacute onset dysfunction of the spinal cord and characterized by variable lower limb and/or upper limb weakness, horizontal level of sensory loss and bladder-bowel disturbances in which secondary etiologies have substantially been excluded.

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Non-compressive myelopathy (NCM) generates a great deal of interest among medical fraternity. It may involve otherwise healthy and relatively younger individuals; its etiology may vary with age, geographical location, food habits, and other associated factors. NCM patients may remain left with a variable degree of neurological sequelae. There are a number of studies covering various aspects of this illness. A similar study was conducted in the same institute a couple of decades earlier. The present study was aimed to re-explore any changes in the trends of etiologies related to NCM with the added advantage of MRI. In this study, we want to present our experience with various non-compressive myelopathies with reference to ATM. We aimed to identify the radiological features across various etiologies of NCM.

MATERIALS AND METHODS

This was a cross-section descriptive study. The study was carried at Bangur Institute of Neurosciences, Kolkata. All the patients attending the neuromedicine outpatient department with signs and symptoms of myelopathy were screened and enrolled in the study. Written consent was taken before the study. A total of 105 patients were screened during the study period. They were investigated for cerebrospinal fluid (CSF) study, evoked potential, biochemical profiles, and radiological imaging. 73 patients were finally diagnosed as cases of NCM. They were further evaluated to establish the etiology of NCM. MRI of spine with contrast was conducted in all 73 patients while MRI of brain was done in 44 patients. 1.5 tesla machine was used for MRI brain and spine. The MRI spine findings were subdivided into three groups long segment (spanning over >2 vertebral segments), short segment, and normal. Lesions are also categorized depending on the extent of involvement of the cross-sectional area of spine. Contrast study was conducted in all the cases. The etiologies were analyzed and corelated with the MRI findings. The study was ethically approved by Institutional Ethical Committee.

RESULTS

As shown in Table 1, out of 73 patients included in this study, there were 50 males and 23 females. Mean age at presentation was 32 (range 16-48) years. The mean age in the ATM group was 39.5 (range 20-59) years.

As depicted in Table 2 most common cause of NCM was ATM (42.1%). Second most common cause was found to be multiple sclerosis (MS) (13.7%) closely followed by Vitamin B12 deficiency (12.3%). Tubercular myelitis is also an important cause which cannot be overlooked in our country. Rest of the conditions producing myelopathies formed a small percentage and included 6 cases of tuberculous meningitis, 4 cases of neuromyelitis optica (NMO), and 3 cases of sarcoidosis. 7 were grouped as unknown.

Table 1: Sociodemographic profile of patients (*n*=73)

Variables	Category	Number (%)
Age group (years)	≤20	10 (13.7)
	21-30	20 (27.4)
	31-40	26 (35.6)
	41-50	17 (23.3)
Sex	Male	50 (68.5)
	Female	23 (31.5)
Residence	Urban	43 (58.9)
	Rural	30 (41.1)
Education	Illiterate	15 (20.5)
	Primary+middle	27 (37.0)
	High school and above	31 (42.5)
Occupation	Employed	53 (72.6)
	Unemployed	20 (27.4)
Socioeconomic status	Lower	24 (32.8)
	Middle	35 (48.0)
	Upper	14 (19.2)

Table 2: Etiological profile of NCM (*n*=73)

Etiology	Number (%)
ATM	30 (41.1)
MS	10 (13.7)
Vitamin B12 deficiency	09 (12.3)
Tubercular	06 (8.2)
Vascular	01 (1.3)
NMO	04 (5.5)
Sarcoidosis	03 (4.1)
HSP	01 (1.3)
Post-lightening myelitis	01 (1.3)
Post-radiation myelitis	01 (1.3)
Unknown	07 (9.6)

NCM: Non-compressive myelopathy, MS: Multiple sclerosis, ATM: Acute transverse myelitis, HSP: Hereditary spastic paraplegia, NMO: Neuromyelitis optica

As depicted in Table 3 and Figure 1, most of the MRI changes in spine showed long segment involvement (45.8%) followed by short segment changes (26.3%) and normal in the rest (27.7%). Spinal cord atrophy found in hereditary spastic paraplegia (HSP) did not fall into any category.

Table 4, highlights on the fact that MRI brain was normal in all cases of ATM. Whereas 7 out of 10 cases of MS showed typical findings of demyelination. 50% of cases of NMO showed positive MRI findings.

DISCUSSION

Myelopathy refers to any functional disturbance and/or pathological change in the spinal cord. Myelopathy which does not occurs due to compressive etiologies such as tumors,

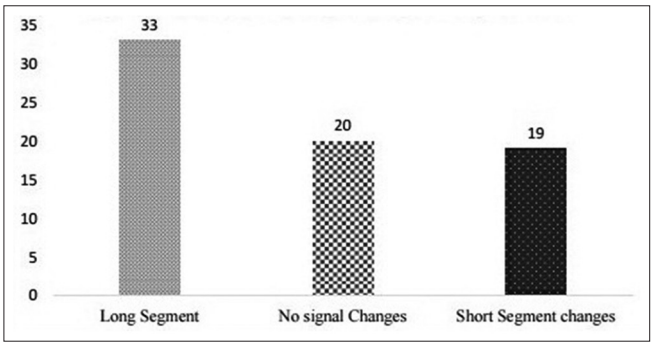

Figure 1: Cord signal changes (*n*=72)

Table 3: Cord signal changes in MRI across various etiologies of NCM (*n*=73)

Etiology	*n* (%)		
	Long segment	Short segment	Normal
ATM	20 (66.8)	05 (16.6)	05 (16.6)
MS	-	08 (80.0)	02 (20.0)
Vitamin B12 deficiency	05 (55.5)	-	04 (44.4)
Tubercular	03 (50.0)	02 (33.3)	01 (16.7)
Vascular	-	01 (100)	-
NMO	04 (100)	-	-
Sarcoidosis	-	02 (66.7)	01 (33.3)
HSP*			
Post-lightening myelitis	-	-	01 (100)
Post-radiation myelitis	01 (100)	-	-
Unknown	-	01 (14.3)	06 (85.7)

*Spinal cord atrophy found in HSP. NCM: Non-compressive myelopathy, MS: Multiple sclerosis, ATM: Acute transverse myelitis, HSP: Hereditary spastic paraplegia, NMO: Neuromyelitis optica, MRI: Magnetic resonance imaging

Table 4: MRI brain findings across various etiologies of NCM (*n*=44)

Findings	*n* (%)	
	Normal	Abnormal
ATM	30 (100)	-
MS	3 (30)	7 (70)
NMO	2 (50)	2 (50)

NCM: Non-compressive myelopathy, MS: Multiple sclerosis, ATM: Acute transverse myelitis, HSP: Hereditary spastic paraplegia, NMO: Neuromyelitis optica, MRI: Magnetic resonance imaging

infection, and trauma falls under the category of NCM. There are many causes of NCM, which is discussed below.

Majority of patients presented between 21 and 40 years of age with mean age of 30.9 years which suggests that a relatively younger population is affected. There was slight male preponderance. This was in congruence with the studies conducted earlier.[1-4] Majority of these cases belonged to middle-class families, and incidence was more among literate population probably due to more health awareness.

Out of the total number of 30 (41.1%) ATM cases, 26 were males and 4 females. In the previous studies too, there has been male predominance.[1,5-7] The mean age was 30.3 years (range 16-47 years) which is consistent with Prabhakar et al. MRI was normal in 5 cases. The involvement of dorsal spine was found in 10 cases (33.3%), cervical spine in 7 cases (23.3%), cervicodorsal in 7 cases (23.3%), and lumbosacral spine in 1 case (3.3%). Cord myelomalacia was seen in two patients who presented very late after clinical onset. Long segment hyperintensity on T2W images involving multiple segments, was seen in 20 patients while short segment involvement was observed in 5 patients. Out of these 25 patients with abnormal spinal MRI, 15 patients had involvement of central cord, and signal changes occupied >2/3 of cross-section. Cord swelling was seen in 8 patients. In 8 patients hyperintense lesion was eccentric involving <1/2 of cross-section and multi segment (Figure 3). In 5 patients who had asymmetrical clinical onset and progression, hyperintense signal was found to be eccentric in 3 patient and central in 2 patients. A study conducted in the Neurology Department of Guwahati Medical College, Guwahati, from September 2013 to February 2016 on patients of non-compressive myelopathies who underwent MRI showed ATM to be the most common cause of NCM and long segment changes in cord as the most common MRI finding.[2] Another study from North India by Prabhakar et al. reported ATM to be most common cause (54.4%).[1] A similar study from Eastern India was conducted on 82 patients between July 1994 and June 1996.[3] The etiologies of myelopathy were MS, heredodegenerative, systemic lupus erythematosus, electrocution, spinal cord infarction, and clioquinol. In 23 (28.0%) patient's etiology could not be established. ATM was diagnosed in 24 (29.3%) patients. In this study, also ATM formed the major bulk of non-compressive myelopathies comprising 41.1% of all cases.

Out of 73, 10 cases were diagnosed as MS. The diagnosis was done on the basis of history and course of disease, clinical and CSF evaluation. 8 patients showed short segment hyperintensity in the T2W images with patchy enhancement. Cranial MRI was done in all 10 cases. This was found to be abnormal in 7 cases showing long TR hyperintensities involving white matter. Dawson fingers (Figure 4) involving pericallosal areas perpendicular to corpus callosum were seen in 3 cases. Most lesions showed delayed nodular and incomplete ring enhancement T1-hypointensity or halos were seen in 2 cases. Most of the primary demyelinating diseases such as MS show peripherally located short segment changes with involvement of <2/3 of the cross-sectional area of cord.[8] Secondary demyelinating diseases such as ATM usually show long segment changes,[9] centrally located with involvement of >2/3 of the cross section of spine.[10] 100% cases of ATM showed normal MRI of brain although previously 7-50%

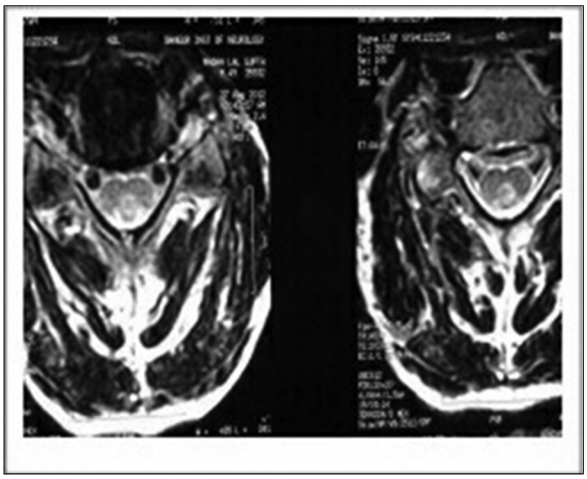

Figure 2: Magnetic resonance imaging spine showing signal changes in posterior column cervical cord Vitamin B12 deficiency

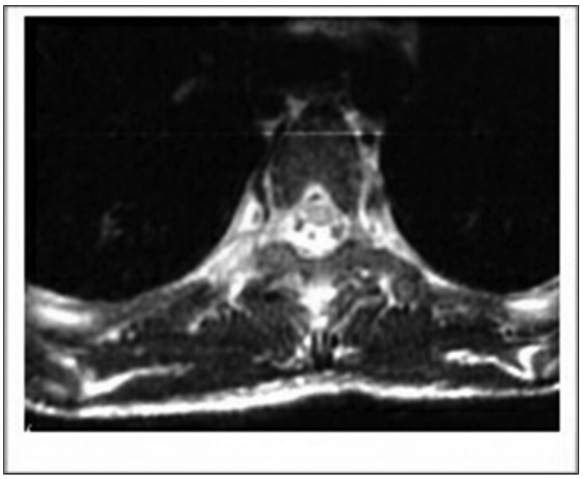

Figure 4: Signal change involving <1/2 of the cross-section area of cord in case of acute transverse myelitis

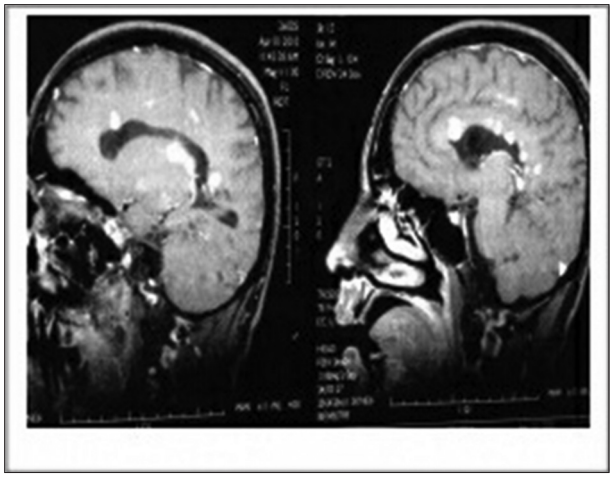

Figure 3: Magnetic resonance imaging brain of multiple sclerosis patient showing enhancing pericallosal plaques (Dawson fingers)

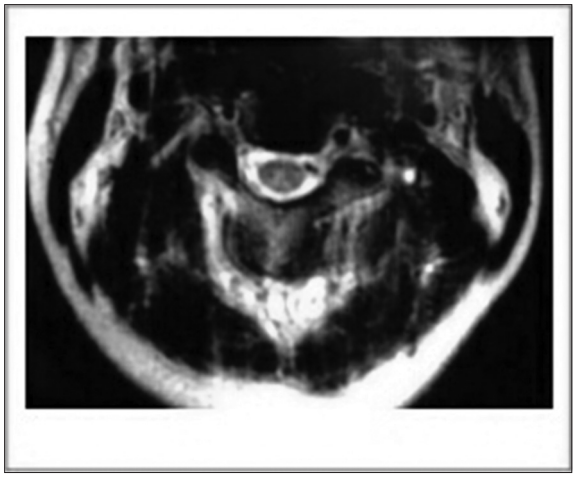

Figure 5: Patchy signal changes in cervical cord involving >2/3 of cross-section area

cases have been reported to be normal.[6,7] This % was very low in MS (30%) where most of the cases showed positive brain finding.

Tubercular myelitis was proven in 6 cases. Although compressive myelopathies are more common in tuberculous spine, the analysis of symptoms, clinical signs, and CSF findings including ADA along with other ancillary tests was corroborative of non-compressive tuberculous myelitis in these set of patients. Out of the 6 cases, spinal MRI was normal in 1 case. 4 cases showed dorsal cord changes, 1 out of these showed cords swelling as well. 1 case showed cervicodorsal cord signal changes. Signal changes in the above cases were in the form of long segment T2 hyperintensity with corresponding T1 isointensity in 3 and hypointensity in 2. Post contrast patchy enhancement was present in cord in all the cases with 3 cases showing epidural enhancement (Figure 5) as well.[11]

B12 deficiency was found to be another important cause. This was present in 9 individuals. MRI spine was normal in 4 cases. Long segment changes in the spinal cord were seen in rest of the 5 cases (55%) with involvement of posterior column of cervicodorsal cord in 4 cases and posterolateral column of cervical cord in 1 case (Figure 2). Pernicious anemia was found to be a factor in the latter. Nerve conduction studies were also undertaken in these patients indicating sensory neuropathy of both the lower limbs.[12]

In 4 cases, the diagnosis established by the neurology department was NMO. The clinical findings, CSF findings of AQP4-IgG (seen in 2 cases) and the long segment involvement of central spinal cord as evidenced by longitudinally extensive T2 hyperintensity involving cervicothoracic region in MRI led to the establishment of the diagnosis. MRI of brain was done in all 4 cases, and it was found to be normal in all cases. Vascular cause was implicated in one patient. On MRI, the combination of cord edema, perimedullary dilated vessels, and cord enhancement was found in this case. Later digital subtraction angiography indicated dural A-V fistula. In 3 cases, the diagnosis was established as sarcoid myelopathy. These were the cases of

systemic sarcoidosis and apart from clinical findings, other ancillary tests, *viz.*, CSF studies, computed tomography thorax, and serum angiotensin converting enzyme (ACE) were also conducted. In one case lymph node biopsy revealed non-caseating granuloma. Serum and CSF ACE was raised in one case. In one case of HSP presented as chronic myelopathy corroborated in MRI spine finding which showed cord atrophy at cervicodorsal level. Similar observation was reported by Hedera et al. Genetic testing could not be conducted due to logistical problems, and the diagnosis was indicated based on family history. MRI spine showed cord atrophy at cervicodorsal level.[4] There was a case of nasopharyngeal carcinoma presenting with post-radiation myelitis. MRI showed T1 hypointensity and corresponding T2 hyperintensity of the lesions involving long segment of the spinal cord.[13] There was contrast enhancement with gadolinium. There was one case of myelopathy that occurred probably as an after effect of lightening injury (Aila cyclone) as was evident from the history. In seven cases (9.58%), no etiology could be established, and imaging also did not indicate any possible diagnosis.

This study tried to correlate the etiology of NCM with the radiological findings, which is a very helpful tool in prognosticating the disease process, especially in MS and NMO. The study has following limitations. MRI brain could not be done in all cases due to limitation of resources. In seven cases, MRI spine findings were nonspecific and could not be categorized in any etiology of NCM.

CONCLUSION

Post-infectious ATM is the most common cause of NCM followed by MS. Vitamin B12 deficiency is the third common cause of myelopathy prevalent in predominantly in vegetarian community. Acute tubercular myelitis has been found to be an important cause of NCM in this region.

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