Original Article

Clinical and Etiological Profile of Non-compressive Myelopathies: Experience from a Tertiary Care Hospital in Pakistan

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ABSTRACT

Objective: To determine the etiological spectrum and clinical profile of non-compressive myelopathies in patients presenting at a tertiary care hospital in Pakistan.

Study Design: Cross-sectional retrospective study

Place and Duration of Study: This study was conducted at the Department of Neurology, Dr Ruth K.M Pfau Civil Hospital Karachi, recording data of patients with non-compressive myelopathies from January 2018 to December 2021.

Materials and Methods: Demographic variables, clinical comorbid conditions, initial presentation, clinical progression, in-hospital management, imaging & laboratory analysis, and response to therapy were recorded from department's records. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 24. Chi-square test with 95% confidence interval was used to compare categorical data. Paired T-test was applied to compare the difference in continuous variables.

Results: Seventy-one patients met the inclusion criteria. Acute to subacute progression of disease was the most common pattern (88.7%), with 45% of patients showing involvement of the thoracic portion of the spinal cord. The most common etiology for non-compressive myelopathy in our study was multiple sclerosis (28.2%). A good response to the treatment regime was reported in more than half of the study population (62%). A significant association was found between time to hospital arrival and disagree of disability.

Conclusion: Multiple sclerosis was the most common etiology of non-compressive myelopathies in this study. The majority of patients were noted to have an acute to subacute onset of disease, involvement of the dorsal region of the spinal cord, and paraparesis.

Key Words: Multiple sclerosis, Non-compressive myelopathy, Paraparesis, Spinal cord disorders.

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INTRODUCTION

Acute and chronic spinal cord pathologies with no evidence of spinal cord compression are common diagnostic problems in neurology. They can be caused by a multitude of underlying neurological pathologies ranging from demyelinating, inflammatory, infectious, metabolic, vascular, and genetic disorders. These disorders are a cause of concern as they cause significant morbidity and may even prove fatal in some cases.

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The first step in order to categorize non-compressive myelopathies is to classify them according to the time to reach maximum deficit. Non- compressive myelopathies are commonly classified as acute, subacute, or chronic.[1] These time frames are considerably helpful in considering etiologies i.e, a subacute presentation may suggest an inflammatory etiology, a hyperacute presentation may point towards a spinal cord ischemic stroke whereas a chronic progression may be representative of a vascular lesion.[2] The progression of disease, therefore, is a useful first discriminator in the quest to reach a diagnosis.[3]

Patients with non-compressive myelopathies present with selective involvement of disparate anatomical regions of the spinal cord which manifest as various well-defined symptoms. Clinically, these patients predominantly present with muscle weakness, sensory involvement, and sphincter involvement. Other symptoms are further identified on the basis of the underlying neurological disease.[2]

Over the years, the approach to myelopathies has changed drastically but a good clinical history and physical examination still remain critically important

diagnostic tools in the initial assessment of myelopathy.[4] The first priority is to rule out a compressive or structural lesion with the help of neuroimaging.[5] At present, MRI with Gadolinium contrast and CSF analysis remain the primary investigations that help physicians to determine the cause of non-compressive myelopathy.[4]

The study of the cerebrospinal fluid is chiefly useful in identifying infectious causes and/or measuring biochemical parameters in order to rule out metabolic causes.[6] The presence of oligoclonal IgG bands detected upon analysis of the cerebrospinal fluid proteins is an important indicator of the B-cell response accompanying CNS inflammation.[7] The most frequently observed imaging finding in myelopathy is either focal or diffuse cord hyperintensity on T2 MRI.[8]

Non-compressive myelopathies are relatively time-sensitive and may be reversible if treated at an early stage, albeit they frequently result in significant morbidity and mortality. IV methylprednisolone is the most widely used treatment regimen in patients with non-compressive myelopathies. IVIG, plasma exchange, Vitamin B12 supplements, and antiretrovirals are commonly used as adjuncts when indicated. In addition to this, immunomodulatory therapy has been used as a popular long-term treatment option.[7]

Insufficient local data is available regarding the socio-demographic, etiological, and clinical factors, and their effects on prognosis and outcomes.

MATERIALS AND METHODS

This cross-sectional retrospective study was conducted in the Department of Neurology, Dr Ruth K.M Pfau Civil Hospital Karachi. Records of patients admitted in the Department of Neurology with non-compressive myelopathy from January 2018 to December 2021 were assessed. The study was exempted from the need of approval by the Institutional Review Board of Dow University of Health Sciences via letter no. IRB-2482/DUHS/EXEMPTION/2022/785. A total number of 71 patients met the inclusion criteria in the study period, and were included via non-probability consecutive sampling.

Inclusion Criteria: Patients admitted in Neurology department with non-compressive myelopathy during the study period. Patients with age >12 years.

Exclusion Criteria: Patients with compressive myelopathy. Patients with incomplete record. Patients who were initially managed in another department /ICU. Patients who were taken against medical advice before completion of treatment.

The hospital records of all the patients were recorded using a standardized pro forma. Demographic variables such as age, gender, residence, clinical comorbid conditions, and initial presentation were documented during admission. Clinical progression, in-hospital management, imaging & laboratory analysis, and response to therapy were recorded. Data regarding patients' progress over the course of their hospital stay were also acquired from the record. The pattern of disease progression was classified as follows: Acute (up to seven days), subacute (seven to 28 days), and chronic (more than 28 days). The patients were managed under a standardized treatment protocol that included intravenous Methylprednisolone and additional treatment for their etiology wherever applicable. Modified Rankin Scale (MRS) at admission and on discharge was used to assess the response to treatment.[11] The Modified Rankin Scale is as follows:

0. No symptoms at all
1. No significant disability despite symptoms; able to carry out all usual duties and activities
2. Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3. Moderate disability; requiring some help, but able to walk without assistance
4. Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5. Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6. Dead

A reduction in score by two or more points in MRS after initial treatment was taken as reference point for improvement in this study.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 24. Descriptive statistics and frequencies were calculated. Chi-square test with 95% confidence interval was used to compare categorical data. Paired T-test was applied to compare the difference in continuous variables. A 5% significance level was used throughout the study. Outcomes in terms of frequencies, relationship, and prognosis were evaluated.

RESULTS

Seventy-one cases of non-compressive myelopathy were recorded during the study period. The median age of our study population was 32 years (IQR=25.0 – 45.0) and more than half of the study participants were male (n= 42, 59%), with 68% of patients belonging to the urban population (n= 48).

In the study group 88.7% of participants were discovered to have an acute to subacute progression of disease (n=63), with 45% of patients showing involvement of the thoracic portion of the spinal cord (n=31) while the cervical region was involved in 23% of cases (n=16). The other patterns of involvement included cervical & dorsal spinal cord (13%), conus medullaris (7%), whole spinal cord (6%), and dorsal spinal cord & conus medullaris (6%).

Flaccid paralysis was determined as the most commonly occurring pattern of weakness (n= 54, 76.1%). In 61% of cases, paraparesis was the predominant type of motor weakness (n=43) and quadriparesis was seen in 32.4% of patients (n=23). A complete sensory level was present in 63% of patients (n=52), and sphincter involvement was found in 66.2% of cases (n= 47).

The most common etiology for non-compressive myelopathy in our study was multiple sclerosis (n= 20, 28.2%) (Figure-1). A significant association was found between the age (in years) of patients and etiology (p=0.00). Multiple sclerosis was reported as the most common etiology in patients falling below the age limit of 50 years. Whereas patients above the age of 50 years were observed to have a uniform distribution among tuberculosis, spinal cord infarction, post-infectious, paraneoplastic, and idiopathic etiologies; detailed illustration is shown in Table-1. A significant association was found between etiology and disease progression (p=0.001); multiple sclerosis (MS) and idiopathic etiology were associated with acute to subacute, and TB and paraneoplastic myelopathy with chronic progression. A significant association was found between etiology and type of sensory involvement (p=0.00); infections were associated with a complete sensory level, demyelinating diseases with hemisensory level or complete sensory level, and vascular etiology with dorsal column sparing.

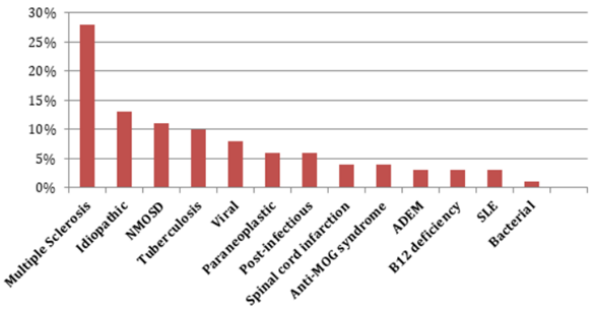

Figure No. 1: Etiologies of non-compressive myelopathies in the study population

NMOSD: Neuromyelitis optica spectrum disorder
Anti-MOG: Anti-myelin oligodendrocyte glycoprotein
ADEM: Acute disseminated encephalomyelitis
SLE: Systemic lupus erythematosus

Cerebrospinal fluid analysis revealed that 64.7% of cases had a raised level of proteins (with a mean protein level of 88.8 mg/dl). Oligoclonal bands were seen in 14.1% of cases, Aquaporin-4 antibodies were seen in 5.6% of cases, and Herpes Simplex Virus (HSV) PCR was found in 4.2% of cases in this study. Results of radiological studies are demonstrated in Table-2.

A good response to the treatment regimen based on MRS was reported in more than half of the study population (n= 44, 62%) while on the other hand 29.6% of patients were reported to have poor response to the initial therapy provided (n= 21). Mortality rate was found to be 8.5% (n=6). Long-term treatment with immunomodulatory therapy was prescribed in 69.8% of patients (n= 44).

Table No. 1: Age Wise Distribution of Etiologies

Etiology	Below 30	30-50	Above 50	Total
NMOSD	3	5	0	8
Multiple Sclerosis	10	10	0	20
Anti-MOG Syndrome	0	3	0	3
Tuberculosis	2	3	2	7
Viral	4	2	0	6
Post-infectious	1	1	2	4
Idiopathic	1	6	2	9
Paraneoplastic	2	0	2	4
SLE	0	1	1	2
B12 Deficiency	1	0	1	2
Spinal Cord Infarction	0	1	2	3
Bacterial	0	0	1	1
ADEM	1	1	0	2
Total	25	33	13	71

NMOSD: Neuromyelitis optica spectrum disorder
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Table No. 2: Radiological Profile of non-compressive myelopathies

Type of Spinal Cord Involvement	Percentage
Transverse	52.1%
Central	18.3%
Peripheral	25.4%
Dorsal Column	2.8%
Dorsal Column Sparing	1.4%
Gadolinium Enhancement Pattern	
Homogenous	43.7%
Patchy	40.8%
Non-Enhancing	9.9%
Ring Enhancement	5.6%
Extent of Spinal Cord Involvement	
Short Segment	50%
Multi-Segment	28.6%
Extensive	21.4%

The median hospital arrival time was six days and the median hospital stay was calculated to be 14 days. Mean MRS on admission was determined to be 4.0 whereas mean MRS after initial treatment was

computed to be 3.1. Association between MRS on admission and after initial treatment was found to be significant (p=0.00). In addition to this, a significant association was found between time to hospital arrival and MRS on admission (p=0.009); as delayed hospital arrival was related to higher MRS on admission. However, an insignificant association was found between etiology and response to treatment (p=0.177).

DISCUSSION

The median age of our study population was 32 years and M:F ratio was 1.4:1. This is in accordance with a study conducted in Northeast India where the median age was 38 years and the M:F ratio was 1.5:1.[7] However, a M:F ratio of 4:1 was noted in a study conducted in Bangladesh.[10]

According to our analysis, multiple sclerosis was found to be the most frequent etiology underlying non-compressive myelopathies (28.2%). In parallel to this, a study conducted in Finland showcased a concordant result with multiple sclerosis being the most common etiology (41%).[11] The study conducted in Northeast India further substantiates our results with demyelination ascertained to be the most common etiology in their study group.[7] The dorsal column of the spinal cord was found to be predominantly involved in the patients included in this study (43.7%) which has been reinforced by a similar result in Nigeria according to which 53.8% of participants had involvement in the thoracic region of the spinal cord.[12] Paraparesis was identified as the most common pattern of weakness (61%). Multiple studies have yielded results that correlate with our findings.[13,14]

Alongside clinical findings, radiological imaging is of significant importance in order to fully exclude the possibility of compressive myelopathy. MRI has proven to be the premier imaging modality for the evaluation of myelopathy, owing mainly to the fact that MRI provides a diagnostic entry point that can guide the use of other investigative modalities for conditions like infections, demyelination or vascular causes.[15-16] In our study, homogenous enhancement was observed to be the most repetitive pattern identified during neuroimaging. In addition, short segment lesions (longitudinal section) and transverse involvement (axial section) of the spinal cord were also common patterns seen on MRI. This is in direct contrast to a study conducted in India which showed a multi-segment lesion with central area involvement of the spinal cord in most of their cases.[16]

Analysis of the cerebrospinal fluid demonstrated the mean protein level being 88.8 mg/dL while on the contrary, the mean protein level was determined to be 147.95 mg/dl in a study conducted in India. Aquaporin-4 antibodies were seen in 5.6% of cases during our investigation which holds a significant dissimilarity with a study conducted in China that showed the presence of Aquaporin-4 antibodies in 31.3% of cases.[16]

Patients were initially started on a treatment regimen of IV Methylprednisolone, on which 62% of patients showed a good response to treatment and a significant association was noted between time to arrival and MRS on admission. (p= 0.009). Similarly, in an Indian study, patients responded positively to IV Methylprednisolone and the study claimed that delayed initiation of IV Methylprednisolone was associated with severe residual disability.[7] On the contrary, an Ethiopian study reported only 33% patients improving with IV methylprednisolone.[17] Early diagnosis of the cause of myelopathy may lead to a significant reduction in disability, mortality rate, and society burden that are caused by delayed management of these conditions.

Considering this is a retrospective study, it is subject to certain limitations. The patients enrolled may have had clinical confounders and/or comorbid conditions that influenced outcomes but were not adequately adjusted for. In addition to this, this study was conducted at a single tertiary care unit therefore the data available was limited. However, this study had a long study duration of four years with the study population belonging to both urban and rural demographics. Furthermore, the data obtained from this study is compatible with international results.

CONCLUSION

Multiple sclerosis was the most common etiology of non-compressive myelopathies in this study. Age and disease progression were established to have a close relationship with etiology. The majority of patients were noted to have an acute to subacute onset of disease, involvement of the dorsal region of the spinal cord, and paraparesis. Furthermore, improvement was seen on initial treatment with IV Methylprednisolone in most of the participants in this study population. The findings of this study throw light to the situation of non-compressive myelopathies in the region, with the hope that this contributes in understanding this burdensome disorder with earlier diagnosis and appropriate treatment being ensured in a timely manner.[21]

Author's Contribution:

Concept & Design of Study:	Wajid Jawaid
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Revisiting Critically:	Wajid Jawaid, Sundus Mehtab Shafee
Final Approval of version:	Wajid Jawaid

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