Clinical Features and Functional Outcome of Patients with Non-compressive Myelopathy: A Hospital Based Cross Sectional Study from a Tertiary Care Center of Dhaka

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Abstract

Background: *Non-compressive myelopathy (NCM) has a wide temporal and clinical profile with etiology that varies over different geographical locations. The etiology may vary according to age, sex, geographical location and other associated factors. There remains a great deal of heterogeneity in clinical features and imaging findings. The functional outcome also differ according to etiology, extent of involvement and rapidity of the management.*

Aims: *To evaluate the clinical features and functional outcome of patients with non-compressive myelopathy.*

Methods: *This observational study was carried out in the Department of Neurology, Neurosurgery and Medicine of Dhaka Medical College Hospital, Dhaka, during January2018 to December 2019. A total of 84 patients suffering from non-compressive myelopathy were included in this study. Age >18 years, both male and female patients with features of myelopathy admitted within 14 days of onset were enrolled in this study and followed up for 180 days.*

Results: *40 (47.5%) patients had acute transeverse myelitis (ATM) without spinal shock followed by 26(30.9%) had ATM with spinal shock, 9(10.8%) had multiple sclerosis (MS), 6(7.2%) had neuromyelitis optica (NMO) and 3(3.6%) had neuromyelitis optica specterum disorders (NMOSD). More than one third (38.2%) patients belonged to age 18-20 years followed by 22(26.3%) in 21-30 years, 20 (23.9%) in 31-40 years, 6(7.2%) in 41-50 years and 4(4.8%) in >50 years. Male to female ratio was almost 2:1. Almost two third (63.1%) patients had paraplegia and 31(36.9%) had quadriplegia. Three fourth (75.0%) patients had sudden onset and 21(25.0%) had insidious onset. More than three fourth (84.5%) patients had sensory involvement. Two third (65.5%) patients had bowel and bladder involvement. The mean Modified Rankin Scale (MRS) score on admission was 4.3±0.86 and 3.13±1.15 at 180 days. The difference was statistically significant ($p<0.05$) between MRS score on admission and MRS score at 180 days. Almost half (48.0%) patients had improved MRS score, followed by 20(20.0%) static, 16(16.0%) worse. The mean barthel index was 34.35±16.71 and 50.06±19.75 on admission and at 180 days (p value <0.01). More than half (53.0%) patients had improved barthel index, followed by 22(22.0%) worse, 16(16.0%) lost to follow up and 9(9.0%) static.*

Conclusion: *ATM was the most common diagnosis among non-compressive myelopathy; with the 2nd decade of the life being the most common age group and predominantly affecting male. Patients with non compressive myelopathy most commonly presented with paraplegia, sudden onset symptoms, sensory involvement, bowel and bladder dysfunction. More than half of the patient improved at day 180.*

Keywords: *Non Compressive Myelopathy (NCM).*

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Introduction

Myelopathies commonly present with motor and sensory deficits along with sphincter disturbances. The clinical presentation and causes of compressive myelopathies characteristically differ from those of non-compressive myelopathies, although rare presentations in either category can mimic each other and pose a diagnostic dilemma to the astute clinician.[11]The management strategies between compressive and non-compressive myelopathies differ dramatically, as compressive lesions usually require urgent neurosurgical intervention and decompression of the spinal cord,[2] whereas non compressive myelopathies are usually amenable to medical treatment itself.[3] Myelopathies usually present with devastating neurological consequences like para/quadriparesis, neurogenic bladder, decubitus ulcers, spasticity, etc which can impair the quality of life and independence of the affected individual. The sequelae of spinal cord disorders are myriad, with few diseases like subacute combined degeneration showing dramatic response to treatment, producing only a mild impact on the patients daily life, whereas some cases of acute transverse myelitis or cord compression can hamper the vital functions of mobility, sensation, bladder and bowel control, making the patient completely dependent on their caregivers.[4-6] The disease spectrum varies and is somewhat different in Asian countries. Infectious and nutritional diseases are common in this part of the world while demyelinating and HIV associated diseases are common in western and African countries respectively. Quadriparesis and paraparesis due to nontraumatic myelopathies are common neurological diseases with high morbidity (up to 79% of patients was definitely remain disabled) and mortality.[7,8] An increasing understanding of the underlying etiological factors were beneficial in managing spinal cord diseases more comprehensively. Adherence to the following practice was enhance the probability of early detection of important myelopathies and thereby was reduce the morbidity and economic burden of the diseases.[9]

As far the knowledge goes relatively small numbers of studies have focused on the clinical pattern of involvement in non-compressive myelopathies and their functional outcome in this country. So, this study would help us in finding the pattern of involvement, etiological profiles and functional outcome of patients with non-compressive myelopathies and thereby helps in their management.

In this study we assessed the clinical presentations of patients admitted with non-compressive myelopathy (NCM) and determined the functional outcome of the patients according to Modified Rankin Scale (MRS) and Barthel index (BI) at 180 days.

Methodology

This was Hospital-based observational cross-sectional study, carried out in the departments of Neurology, Neurosurgery and Medicine of Dhaka Medical college Hospital from January 2018 to December 2019. Following admission, patients with non-compressive myelopathies were sorted out according to inclusion & exclusion criteria. All of the study population was counselled regarding the aim, objective & significance of the study. Written informed consent was obtained from each patient and the researcher personally conducted interviews using a semi-structured questionnaire. Information regarding the demographic profile (age, sex) and clinical presentation was recorded in the questionnaire. Patients admitted within 14 days of onset of event and treated with i.v methylprednisolone for 5 days were included in this study. Upon admission functional outcomes were quantified using the Modified Rankin Scale (MRS) and Barthel Index (BI). MRI findings, CSF analysis results and other laboratory reports were recorded. The functional outcome of the patients was reassessed by the principal investigator on day 180 (via telephone for discharged patients).

Inclusion and exclusion criteria

We included patients with age more than 18 years, both male and female patients with features of myelopathy (paraplegia or quadriplegia with or without bowel and bladder disturbances), with or without spinal shock and

admitted within 14 days of onset were included in this study. All the patients gave informed written consent. Patients with history of trauma, spinal cord compression on MRI associated peripheral neuropathy, myopathy and stroke were excluded from the study.

Operational definition

Non-Compressive Myelopathy[7] was described as non-compressive myelopathy encompasses a large range of disease entities ranging from demyelination, infection, nutritional, toxic, heredo-familial to degenerative conditions. ATM was diagnosed as per criteria proposed by Transverse Myelitis Consortium Working Group (TMCWG 2002).[10] The diagnosis of multiple sclerosis (MS) was based on 2010 Revised McDonald Criteria.[11] NMO & NMO spectrum disorder (NMOSD) was diagnosed based on 2015 International Panel for NMO Diagnosis criteria.[12] The term "Spinal shock" applies to all phenomena surrounding physiologic or anatomic transection of the spinal cord that results in temporary loss or depression of all or most spinal reflex activity below the level of the injury.[13]

Ethical clearance

Ethical approval was also obtained from the ethical review committee of the study hospital.

Results

In this study, total 84 patients were evaluated, 53 males and 31 females with a male to female ratio 1.7:1(Table I).

Table I

Distribution of the study patients by sex (n=84)

Sex	Number of patients	Percentage
Male	53	63.1
Female	31	36.9

It was observed that more than one third (38.2%) patients belonged to age ≤20 years followed by 22(26.3%) in 21-30 years, 20 (23.9%) in 31-40 years, 6(7.2%) in 41-50 years and 4(4.8%) in >50 years. The mean age was 27.74±13.39 years with range from 18 to 72 years (Table II).

Table II

Distribution of the study patients by age (n=84)

Age (years)	Number of patients	Percentage
≤20	32	38.2
21-30	22	26.3
31-40	20	23.9
41-50	6	7.2
>50	4	4.8
Mean ± SD	27.74 ± 13.39	
Range(min-max)	18-72	

It was observed that 40(47.5%) patients had ATM followed by 26(30.9%) had ATM with spinal shock, 9(10.8%) had MS, 6(7.2%) NMO and 3(3.6%) NMOSD (Table III).

Table III

Distribution of the study patients by Etiology (n=84)

Etiology	Frequency	Percent
ATM without spinal shock	40	47.5
ATM with spinal shock	26	30.9
MS	9	10.8
NMO	6	7.2
NMOSD	3	3.6
Total	84	100

This study also observed that almost two third 53(63.1%) patients had paraplegia and 31(36.9%) had quadriplegia. It was also observed that more than three fourth (84.5%) patients had sensory involvement and two third (65.5%) patients had bowel and bladder involvement (Table IV).

Table IV

Clinical Profile

Clinical features	Frequency	Percentage
Paraplegia/Paraperesis	53	63.1
Quadriplegia/quadriperesis	31	36.9
Sensory symptoms present	71	84.5
Sensory symptoms absent	13	15.5
Bowel & Bladder involvement present	55	65.5
Bowel & Bladder involvement absent	29	34.5

Table V showed the most common sites of involvement were dorsal 33(39.5%) and cervical 26(30.9%) of study subjects. In MRI findings T2 WI signal changes were present in 78(92.8%) of study populations, among them 3 or more segments of vertebral length were involved in 64(76.2%) patients (Table V).

Table V

MRI findings in the study subjects (n=84)

Level of involvement n (%)	MRI features n (%)
Normal 6(7.1%)	T_2 Hyperintesity 78(92.8%)
Cervical 26(30.9%)	
Dorsal 33(39.5%)	Length of involvement
Cervicodorsal 13(15.4%)	a. ≥3 segments: 64(76.2%)
Dorsolumbar 6(7.1%)	b. <3 segments: 14(16.6%)

The mean MRS score on admission was 4.3±0.86 with range from 2 to 5. More than half (53.6%) patients belonged to MRS score 5 on admission. Almost half (47.6%) patients belonged to MRS score 4 at 180 days. The mean MRS score at 180 days was 3.13±1.15 with range from 1 to 5. The difference was statistically significant (p<0.05) between two groups (Table VI).

Table VI

Distribution of the study patients by MRS score (n=84)

MRS score	On admission n	%	At 180 days n	%	P value
1	0	0.0	9	10.7	
2	2	2.4	19	22.6	
3	16	19.0	12	14.3	0.001[s]
4	21	25.0	40	47.6	
5	45	53.6	4	4.8	
Mean±SD	4.3±0.86		3.13±1.15		

Table VII

Distribution of the study patients by barthel index (n=84)

Barthel index	On admission n	%	At 180 days n	%	P value
1-20	22	26.2	4	4.8	
21-40	35	41.7	31	36.8	0.001[s]
41-60	21	25.0	25	29.7	
61-80	6	7.1	24	28.7	
Mean±SD	34.35±16.71		50.06±19.75		0.001[s]

The mean barthel index on admission was 34.35±16.71 with range from 5 to 80. More than one third (41.7%) patients belonged to barthel index 21-40 on admission. More than one third (36.8%) patients belonged to barthel index 21-40 at 180 days. The mean barthel index at 180 days was 50.06±19.75 with range from 20 to 90. The difference was statistically significant (p<0.05) between two groups (Table VII).

Discussion

A total of 84 pastients suffering from non-compressive myelopathy attended in the Neurology, Neurosurgery & Medicine department of Dhaka Medical College Hospital, Dhaka, during January 2018 to December 2019 were included in this study. ATM is a monophasic illness and represents a localized form of post infectious encephalomyelitis. In this study acute transverse myelitis is more likely to cause paraparesis than quadriparesis (56.94% cases VS 21.05%) cases. Overall incidence of ATM causing quadriparesis and

paraparesis was 13.0% and compatible with the findings.[14] Regarding the diagnosis, in this present study, it was observed that 47.5% patients had ATM followed by 30.9% had ATM with spinal shock, 10.8% had MS, 7.2% NMO and 3.6% had NMOSD. Anusha study findings showed that acute transverse myelitis comprised 47.91% of the cases.[15] Another Indian study describing the spectrum of compressive myelopathies also showed that spinal tuberculosis was the commonest cause 24.6% followed by spinal metastases 17.4%.[16] According to Transverse myelitis consortium working group (TMCWG), ATM is classified according to Idiopathic and secondary to diseases like MS, NMOSD and connective tissue disorders.[17] In one study rather than making broad diagnosis of ATM, patients were classified according to etiology of ATM, because treatment and prognosis differ according to etiology of ATM.[18] In their study, patient was diagnosed as post-infectious ATM if had a clear history of febrile illness within 30 days preceding onset of myelitis. Another Indian studied 43 patients of ATM and found that 17 had tetraplegia, 26 had paraplegia and 36 had bladder involvement.[19]

A study observed 30 patients, out of which 41.1% had ATM cases.[20] Cord myelomalacia was seen in two patients who presented very late after clinical onset. A study conducted by 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.[21] A Indian study mentioned that the etiologies of myelopathy were MS, neuro-degenerative, systemic lupus erythematosus, spinal cord infarction and idiopathic ATM was diagnosed in 29.3% patients.[20] In this current study, it was observed that 38.2% patients belonged to age ≤20 years followed by 26.3% in 21-30 years, 23.9% in 31-40 years, 7.2% in 41-50 years and 4.8% in >50 years. The mean age was 27.74±13.39 years with range from 18 to 72 years. A Bangladeshi study found age range varied from 15 to 74 years and the highest number of patients (26.0%) was in the age group 51-60 years, followed by 24% patients in the age group 31-40 years, which is comparable with the current study.[22] The age range in this study are similar to other studies.[7,14] In another study observed that age of presentation varied from 14 to 75 years, which also support the present study.[23] However, Thangaraj and Jayasankar found that the mean age of their patients was 34.5 years.[24] In another study Kamble et al. showed the median age of their study population was 38 years, which is higher with the present study.[14] Prabhakar et al. reported the clinical and radiological findings in 57 Indian patients with non-compressive myelopathy having a mean age of 34.45 years which was also higher than the present study.[7] The higher mean age and age range obtained by the above authors may be due to geographical variations, racial, ethnic differences, and genetic causes may have significant influence in their study subjects.

World Health Organization (WHO) reported that the incidence of non-traumatic myelopathies is higher in male than females and incidence steadily increases with age (World Health Organization and International Spinal Cord Society, 2013).[25] Similarly, in this present study, it was observed that non compressive myelopathy was more common in male subjects, which is consistent with Anusha study, where they found 59.0% were males and the rest 41.0% were females.[15] Male predominance may be due to the culture of our society where male are more likely admitted in the hospital and more bed for male patients in the ward. Similarly, Thangaraj and Jayasankar also showed predominant male affection, i.e male to female ratio was 1.9:1.[24] Similar observations regarding the male predominant were also observed in other stufies.[18,22,23]

In this current study, it was observed that 56.0% patients were rural and 44.0% were urban. Similarly, Singh et al. found that 58.9% and 41.1% patents came from Urban and rural area respectively.[20]

In this present study, it was observed that 63.1% patients had paraplegia and 36.9% had quadriplegia. Kamble et al. found quadriparesis in 67.5%, Paraparesis 30.0% and Bibrachial

weakness 1.3% in their studied patients[18]. Thangaraj and Jayasankar observed that bibrachial weakness in 6.9% and Quadriparesis had 28.8% of the patients.[24] Haleem et al. also observed that 92.3% presented with paraplegia and 7.7% presented with quadriplegia.[22] Watson et al. showed that 79.6% had weakness of lower limbs (paraplegia) on presentation while 20.3% patients had involvement of all four limbs (quadriplegia).[23] Anusha observed in patients with nontraumatic myelopathy had paraparesis at presentation whereas 46.0% were quadriparetic. One patient presented with brachial monoparesis, 8.3% patients did not manifest with any weakness and had presented to the hospital with non-motor complaints only.[15]The above studies findings are comparable with the present study. In this current study, it was observed that 75.0% patients had sudden onset and 25.0% had insidious onset. He also observed that onset of illness was acute in 22.0% patients. Subacute onset was noted in another 20.0% whereas 58 patients had a chronic and progressive course prior to presenting to the hospital.[15]

In this present study, it was observed that 84.5% patients had sensory involvement. Thangaraj and Jayasankar found that posterior column sensory loss had 26.7% and Spinothalamic sensory loss had 24.4%.[24] Kamble et al. observed that posterior column sensory loss had 51.3% and spinothalamic sensory loss 45.0%[18]. Haleem et al. study showed that 90.3% cases had some sort of sensory symptoms and 51.6% had involvement of bowel and bladder.[22] In another study Anusha observed that sensory complaints were present in 69.0% of their study patients. In those patients, 44.0% patients presented with a sensory level, 10.0% patients manifested with glove and stocking type of sensory loss, 8.0% patients had radicular pattern of sensory loss, 5.0% patients manifested with diffuse funicular pain, and only 2.0% patients had hemi sensory loss.[15]

Regarding the bowel & bladder involvement in this current study, it was observed that 65.5% patients had bowel & bladder involvement. Haleem et al. showed that more than half (51.6%) of the patients had involvement of bowel and bladder.[22] Ozkan et al. studied 50 patients, among them, 12.0 cases having bladder and bowel dysfunction.[27] Kalita et al. found that bladder involvement in 50.0% cases.[6] Milross et al. observed that bladder dysfunction in 44.68% cases and bowel dysfunction in 38.29% cases.[26] In their study 91.7% patient had sensory symptoms and involvement of both bowel and bladder. This result is higher than the present study. This may be because of selection criteria, diagnosis far too late and less awareness of cancer metastasis.

Regarding the MRS Score on admission in this present study, it was observed that 53.6% patients belonged to MRS score 5 on admission and 47.6% patients belonged to MRS score 4 at 180 days. The mean MRS score on admission was 4.3±0.86 with range from 2 to 5 and 3.13±1.15 with range from 1 to 5 MRS score at 180 days. The difference was statistically significant ($p<0.05$) between MRS score on admission and at 180 days. In this present study, it was observed that 48.0% patients had improved MRS score, followed by 20.0% static, 16.0% worse and lost to follow up respectively. Christensen et al. (1990) described the long-term follow-up of 29 cases of acute transverse myelopathy and noted that one third had a good outcome, while one third had poor outcome. Back-pain and signs of spinal shock were found to indicate worse outcome in his study. Anusha showed improvement in 25.0% and worsening in 3.0%, whereas Barthel index showed improvement in 40.0% and worsening in 8.0% of the patients.[15]

Regarding the Barthel index on admission in this current study, it was observed that 41.7% patients belonged to barthel index 21-40 on admission and 36.8% patients belonged to 21-40 at 180 days. The mean barthel index on admission was 34.35±16.71 with range from 5 to 80 and 50.06±19.75 with range from 20 to 90 at 180 days. The difference was statistically significant ($p<0.05$) between Barthel index on admission and at 180 days. In this current study, it was observed that 53.0% patients had improved barthel index, followed by 22.0% worse, 16.0% lost to follow up and 9.0% static.

Anusha study observed that the mean Barthel index score at initial presentation was 51.15±19.67 with a ranged from 5 to 100. The corresponding mean MRS score was 3.29±0.81 with values ranging between 0 and 5 in the patients with non traumatic myelopathy.[15]

There was some limitation of this study, includes the small sample size, short duration of the study period, follow up was done over phone most of the patients. The study population was selected from one hospital in Dhaka city, so that the results of the study may not reflect the exact picture of the country.

Conclusion

ATM was the most common diagnosis. Non-compressive myelopathy affected people across all adult age groups but most of them were in 2nd decade and male predominant. Paraplegia, sudden onset, sensory involvement, bowel & bladder involvement were more common in patients with non-compressive myelopathy. Nearly a half improved according to MRS Score and more than a half improved according to Barthel index.

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