ORIGINAL ARTICLE

A Clinical Profile of Transverse Myelitis with Special Reference to Outcomes: A 5-Year Retrospective Study

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Abstract

Introduction: Transverse myelitis (TM), a rare inflammatory condition affecting the spinal cord, presents with a rapid onset of bilateral motor and sensory symptoms with or without bladder/bowel and sexual dysfunction. Recent studies are attempting to identify its improvement, worsening, or conversion to multiple sclerosis, and the factors that determine these outcomes. The present study aims to assess the immediate and long-term outcomes of TM and to determine the factors associated with them.

Materials and methods: The study involved a retrospective review of hospital records of 30 patients diagnosed with TM between 2018 and 2022, followed by a telephonic interview to assess their present outcomes.

Results: Median age of the patients was 40 years [Interquartile range (IQR) = 30–48.5], with 53% males. About 76.7% had longitudinally extensive transverse myelitis (LETM). Onset was acute in 63.3%. Half (50%) of the patients had paraparesis. MRI spine showed involvement of the long segment in 65.5% and the short segment in 24.1%. At the end of treatment, 43.3% patients improved partially, and 16.7% improved completely. At follow-up, nearly 30% of the respondents reported complete recovery, while 8.3% reported worsening. One patient (3.33%), with an acute onset of TM, quadriparesis, bowel involvement, sexual dysfunction, and long spinal segment involvement, converted to multiple sclerosis at follow-up. 25% of patients with initial partial improvement showed complete improvement at follow-up.

Conclusions: Acute onset LETM cases can potentially convert to multiple sclerosis. Patients who show early improvement, whether partial or complete, have higher chances of complete recovery at follow-up.

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Introduction

Transverse myelitis (TM), a relatively rare disease characterized by inflammation of the spinal cord involving its length as well as width, presents with a rapid onset of bilateral weakness of the limbs and sensory deficit with or without bladder/bowel/ sexual dysfunction.[1,2] Its etiology may be classified as infectious/postinfectious, autoimmune, and idiopathic.[3] Its clinical manifestations depend primarily on the location of the lesion and the severity of involvement of the spinal cord.[4] Its treatment includes intravenous steroids or immunoglobulins, plasmapheresis, monoclonal antibodies, rehabilitation, and supportive care.[5] Despite this, its outcomes differ from person to person and depend on the etiology, site, and severity of spinal cord involvement. and the time of initiation and nature of the treatment. The present study aims to assess the immediate and long-term outcomes of TM and to determine the factors that influence these outcomes.

Selection Criteria

- Presentation of symptoms and signs of acute noncompressive myelopathy.
- Evolution of symptoms for no more than 4 weeks, sustained for at least 48 hours, and maximum peak reached in more than 4 hours.
- No evidence of symptoms or signs suggestive of cranial involvement.[6]
- Absence of any other chronic neurodegenerative disorders.

Materials and Methods

Study Design

Retrospective analytical follow-up study.

Study Site

Apollo Hospitals, Chennai, Tamil Nadu.

Study Subjects

Patients diagnosed with TM between 2018 and 2022.

Sample Size

Hospital records of patients diagnosed with TM between 2018 and 2022 were reviewed. A total of 30 patients who met the selection criteria were enrolled in the study.

Data Collection

The case sheets of the 30 patients with TM were retrieved from the medical records department. A semistructured questionnaire format was used to collect the data on their clinical history, diagnosis, and immunological and radiological findings. A telephonic follow-up interview was done to obtain details of their present status. The initial modified Rankin Score (mRS) scores at the time of presentation were estimated based on the documented history and examination. The outcome of each patient at the time of discharge is recorded as the "initial" outcome. Final mRS scores, as well as "final" outcomes or "outcome at follow-up," were estimated based on their responses to the telephonic interviews.

Statistical Analysis

Data were managed, cleaned, coded, and analyzed using Microsoft Excel 2010 and SPSS version 21.0. Continuous variables are described in the form of Median and interquartile ranges (IQR). Categorical variables are described in the form of frequencies and proportions. The outcomes were compared with respect to various dependent and independent variables to understand the effects of each variable on the initial outcomes and outcomes at follow-up.

Results

The median age of the patients was 40.5 years (IQR = 30.5–48.75 years), and males and females were almost equally involved, with a slight male predominance (16/30, 53.33%), with a sex ratio of 8 males per 7 females (1.14) (Table 1).

Sensory involvement was noted in 24/30 (80%) of subjects. Pain and temperature involvement was seen in 22/24 (91.67%); among these, it was most common (12/24, 50%), and only 2/24 (8.3%) had vibration and proprioception involvement. Involvement

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of both pain and temperature, as well as vibration and proprioception, was seen in 10/24 (41.67%). Paresis of varied severity was seen in 21/30 (70%) subjects, among which paraparesis was most common (16/21, 76.2%), followed by Brown-Sequard-like partial weakness (i.e., unilateral partial loss of power in upper and lower limbs) seen in 3/21 (14.3%) and quadriparesis seen in 2/21 (9.5%). Complete paralysis ("plegias") was seen in 9/30 (30%), including paraplegia in 8/9 (88.9%) and Brown-Sequard-like complete weakness (i.e., unilateral complete loss of power in upper and lower limbs) in 1/9 (11.1%).

Bowel involvement was seen in 22/30 (73.33%), and bladder involvement was seen in 21/30 (70%) subjects. Visual symptoms were noted in 3/30 (10%) subjects, including two subjects with monocular and one subject with binocular involvement.

MRI was done in 29/30 subjects, wherein involvement of the spinal cord long segment, i.e., *>3 vertebral segments*, was seen in the majority of the subjects (19/29, 65.5%), followed by spinal cord short segment, i.e., ≤3 vertebral segments, in (7/29, 24.1%). Only three subjects (10.3%) showed involvement of the brain and spinal cord long segment on MRI. Hence, based on the nature of spinal cord and brain involvement identified by MRI, longitudinally extensive transverse myelitis (LETM) was the predominant diagnosis among the subjects (22/29, 75.86%).

Radiologically, the most common site of lesion was thoracic in 15/29 (51.73%), followed by cervical in 6/29 (20.68%). In comparison, 4/29 (13.79%) showed cervical and thoracic cord involvement, one (3.45%) subject had thoracic and lumbar involvement, two (6.90%) had extensive involvement from thoracic to conus, and one (3.45%) subject had extensive involvement from cervical to lumbar region (Fig. 1).

A contrast study, along with MRI, was done on 26 subjects. Normal findings (no enhancement) were documented in 17/26 (65.4%), whereas enhancement was reported in 9/26 (34.6%). Three out of these 9 subjects (33.3%) showed leptomeningeal enhancement; among them, one subject had autoimmune etiology with positive antihistone antibodies, and the other two subjects had parainfectious etiology. One out of the 9 subjects (11.1%) with contrast enhancement was positive for antinuclear antibodies (ANA).

Cerebrospinal fluid (CSF) analysis was done in 23/30 (76.67%) subjects, among which 4/23 (17.4%) had abnormal CSF cell counts (> 10 cells/dL, with no polymorphonuclear cells) and 11/23 (47.8%) had raised CSF proteins (> 45 mg/dL).

The findings of various serological investigations are documented in Table 2.

Table 1: Baseline characteristics of Transverse myelitis cases

Characteristics	*Frequencies (proportions)*
Median age [IQR]	40.5 years [30.5–48.75 years]
Gender	
Males	16/30 (53.3%)
Females	14/30 (46.7%)
Onset	
Acute (<1 week)	19/30 (63.3%)
Subacute (1 – 4 weeks)	11/30 (36.7%)
Weakness	
Paresis	21/30 (70%)
Paraparesis	16/30 (53.3%)
Quadriparesis	2/30 (6.7%)
Brown-Sequard-like	3/30 (10%)
Plegia	9/30 (30%)
Paraplegia	8/30 (26.7%)
Brown-Sequard-like	1/30 (3.3%)
Bowel involvement	
Present	22/30 (73.3%)
Absent	8/30 (26.7%)
Bladder involvement	
Present	21/30 (70%)
Absent	9/30 (30%)
Visual symptoms	
Present	3/30 (10%)
Absent	27/30 (90%)
CSF Analysis	Done in 23/30, Not done in 7/30
CSF cell counts:	
Normal	19/23 (82.6%)
Abnormal	4/23 (17.4%)
CSF proteins	
Normal	12/23 (52.2%)
Abnormal	11/23 (47.8%)
MRI findings	
Not done in	1/30
Spinal cord Long segment	19/29 (65.5%)
Spinal cord Short segment	7/29 (24.1%)
Brain + spinal cord long segment	3/29 (10.3%)

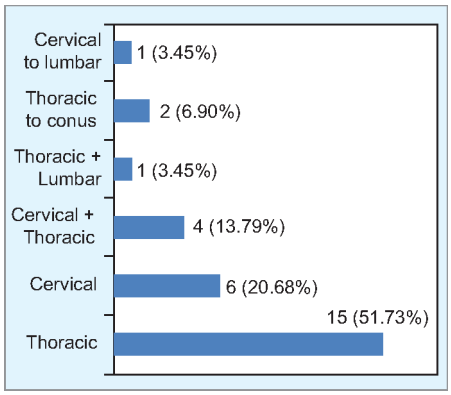

Fig. 1: Distribution of Transverse myelitis cases based on site of lesion (*n* = 29)

Table 2: Findings of serological investigations of transverse myelitis cases

Investigations	*Frequencies (proportions)*
Serological investigations done	11/30 (36.7%)
Positive serological reports	5/11 (45.4%)
SSA Antibodies	1
Anti-histone Antibodies	1
CENP + ANA Antibodies	1
ANA antibodies alone	2
The MOG antibody test was done in	20/30 (66.7%)
Positive in	1/20 (5%)

Table 3: Comparison of baseline characteristics and clinical presentations based on early outcomes (*n*, row%)

Early outcomes (n = 30)	*Completely improved (5, 16.67%)*	*Partially improved (13, 43.33%)*	*No change (12, 40%)*
Median age (in years)	36	33	46
IQR	32–41	29–50	36–47.25
Onset			
Acute (19, 63.33%)	4 (21.0%)	8 (42.1%)	7 (36.9%)
Subacute (11, 36.67%)	1 (0.9%)	5 (45.45%)	5 (45.45%)
Gender			
Male (16, 53.33%)	3 (18.75%)	6 (37.5%)	7 (43.75%)
Female (14, 46.67%)	2 (14.3%)	7 (50%)	5 (35.7%)
MRI findings (*n* = 29)			
SSTM (7, 24.14%)	3 (42.8%)	2 (28.6%)	2 (28.6%)
LETM (22, 75.86%)	2 (9.1%)	11 (45.45%)	10 (45.45%)
Weakness			
Paresis (21, 70%)			
Para (16, 53.33%)	2 (12.5%)	8 (50%)	6 (37.5%)
Quadri (2, 6.67%)	2 (100%)	0 (0%)	0 (0%)
One-sided (3, 10%)*	1 (33.33%)	1 (33.33%)	1 (33.33%)
Plegia (9, 30%)			
Para (8, 26.67%)	0 (0%)	3 (37.5%)	5 (62.5%)
One-sided (1, 3.33%)	0 (0%)	1(100%)	0(0%)

*One-sided (Brown-Sequard-like), unilateral complete loss of power in upper and lower limbs

Myelin oligodendrocyte glycoprotein (MOG) antibody test was done for 20 subjects, and 1/20 (5%) showed positive results. Aquaporin antibodies were tested in 22 subjects, but were negative in all. Fourteen subjects were tested for oligoclonal bands (OCB) in CSF, and only one was positive. Serological investigations were done for connective tissue disorders in 11/30 (36.67%), and 5/11 (45.4%) were positive for antibodies, with 1 in each (CENP + ANA, SSA, and antihistone), and ANA antibodies alone were positive in 2/22 (9.09%).

Distribution according to the etiological classification of TM showed that idiopathic TM was most common (15/30, 53%), followed by postinfectious (7/30, 23.33%). 2/30 (6.7%) had COVID-19 infection, while 5/30 (16.7%) had various systemic autoimmune conditions [Including SLE (3), SJS (1), and CREST syndrome (1)]. Onset was acute, i.e., developing over a few hours to 1 week, in nearly two-thirds (19/30, 63.33%), while the remaining (11/30, 36.67%) had subacute onset, i.e., developing over 1 to 4 weeks.

Treatment was given in a stepwise manner, starting with IV methylprednisolone.

Twenty-nine of 30 (96.67%) subjects, viz., 25/29 (86.2%) received 1000 mg for 5 days and 4/29 (13.8%) received 500 mg of methylprednisolone for 5 days, while one subject received 40 mg of oral prednisolone from the start of treatment. Oral Prednisolone was continued in all of them in tapering doses for the next 15 days. Those who did not show sufficient improvement with steroids were treated with rituximab (6/30, 20%), intravenous immunoglobulins (5/30, 16.67%), or plasmapheresis (3/30, 10%) (Table 3).

The early outcomes at the time of discharge showed that 18/30 (60%) had improved, 5 (27.8%) completely, and 13 (72.2%) partially, while 12 (40%) showed no immediate improvement. During the period of hospitalization, complications were documented in 14/30 (46.7%). The most common complications noted were Urinary tract infections in 7/14 (50%), bedsores in 4/14 (28.6%), steroid-related complications in 3/14 (21.4%), and others, including contractures in 2 (6.67%) and deep vein thrombosis in 1 (3.33%) (Table 4).

During the telephonic follow-up, 25 out of 30 patients were only able to be contacted, and one out of them had died due to the existing comorbid condition of liver failure and multiple organ dysfunction syndrome (MODS). Data from the follow-up interviews showed that 15/24 (62.5%) subjects improved, with 8/24 (33.33%) showing partial improvement and 7/24 (29.16%) showing complete improvement, while 5/24 (20.83%) showed no change. However, two subjects (8.33%) reported worsening of the symptoms. Two subjects developed new symptoms, i.e., Guillain–Barré syndrome and multiple sclerosis, respectively (Table 5).

The initial modified Rankin Score (mRS) of the subjects at the time of their presentation was deduced from the history and examination. However, the final mRS could be assessed for only 24/30 subjects via the telephonic follow-up interview, as five subjects were lost to follow-up and one died due to liver failure. Analysis of mRS scores showed a reduction in the median score from four (IQR = 4–5) at baseline to one (IQR = 0–2) at follow-up. The mRS score improved completely in 9/24 (37.5%) and partially in 12/24 (50%) subjects, while 3/24 (12.5%) showed no change. The number of subjects with bowel and bladder involvement who showed improvement was 8 and 10, respectively.

Three subjects had shown brain and spinal cord long-segment involvement on MRI. Among them, one patient had died. One had completely improved. One subject showed no improvement. Three subjects (10%) had visual symptoms at admission; among them, 2 (66.7%) had monocular involvement and 1 (33.3%) had binocular involvement. All three cases were LETM type with an acute onset of TM. Although one of them showed complete initial improvement, the other two showed no improvement.

The subjects with LETM alone had higher partial improvement initially as well as at follow-up, i.e., 47.4% and 37.5%, respectively. In comparison, short segment transverse myelitis (SSTM) patients have made a high proportion of patients with complete improvement initially as well as at follow-up, i.e., 42.8% and 66.6%, respectively. In contrast to SSTM, LETM subjects had shown worsening (2/18, 11.1%) or development of new symptoms (2/18, 11.1%).

There were 10 subjects with a duration of >4 years between the onset of symptoms and follow-up. Among them, 5/10 cases were lost to follow-up, 1 died, 2/10 developed new symptoms, and 2 showed complete improvement. 4/7 subjects with <1 year duration since onset showed no improvement, 2/7 remained partially improved, while 1/7 showed complete improvement.

Partial improvement was highest among subjects with paraparesis, i.e., 8/16 (50%) at initial assessment and 5/13 (38.4%) at follow-up. Both subjects with quadriparesis had complete initial improvement, but at the time of follow-up, one of them developed new symptoms. The single patient with "Brown-Sequard-like complete weakness" initially showed partial improvement but later worsened by the time of follow-up.

Changes in mRS scores across subjects with different antibodies are depicted in Table 6.

There was one subject with positive oligoclonal bands in CSF alone, and this subject showed partial improvement at follow-up.

Three subjects had extensive involvement of the spine, i.e., from cervical to lumbar in 1 and thoracic to conus in 2 subjects. Although they showed initial partial improvement, one subject had worsened at follow-up, one remained partially improved, and one was lost to follow-up. The subjects with short-segment involvement showed high mRS improvement as compared to long-segment involvement (Table 7).

Analysis of the distribution of outcomes at follow-up, based on the initial outcomes, showed that most subjects with initial partial improvement maintained partial improvement (50%) and complete improvement (25%). One patient with complete initial improvement had developed new symptoms (Table 8).

Discussion

While no significant difference in outcome was observed between patients with acute and subacute onset TM, the small sample size at follow-up precludes definitive conclusions. However, Simone et al.[7] identified rapid onset with complete paraplegia and spinal shock as potential predictors of poor prognosis.

Among patients presenting with TM, paraparesis is the most prevalent symptom. Notably, 81.8% of individuals with paraparesis demonstrate improvement. However, the extent of improvement is inversely proportional to the severity of initial weakness, regardless of presentation pattern (paraparesis, quadriparesis, Brown-Séquard syndrome). This observation aligns with the findings of Defresne et al.[8] who identified paraplegia as a significant predictor of unfavorable prognosis.

Consistent with previous findings by Harzheim et al.[9] demonstrating thoracic spinal cord involvement as the predominant pattern in acute TM, our study identified thoracic cord lesions as the most frequent localization. Notably, 83.33% of patients with isolated thoracic involvement had a positive mRS score, suggesting improvement. Moreover, complete recovery was observed in patients with both isolated cervical lesions and those with extensive lesions encompassing both the cervical and thoracic regions.

Among patients with LETM, 75% demonstrated clinical improvement, whereas 83.3% of those with SSTM did. Interestingly, one LETM patient with two relapses was subsequently diagnosed with clinically defined multiple sclerosis. Notably, CSF cell counts and protein values did not reveal any significant correlation with clinical outcomes.

The median initial mRS score of the subjects was 4 (IQR = 4–5), and it reduced to 1 (IQR = 0–1) at final follow-up. The mRS scores improved in 20/24 (83.3%) subjects, while 3 subjects (12.5%) showed no change. Bowel dysfunction and bladder dysfunction were improved in 38% and 47% of patients, respectively. The higher the initial Rankin score, the poorer the long-term outcome.[10] All subjects underwent a systematic therapeutic approach, commencing with intravenous methylprednisolone. Subsequent to inadequate response to intravenous steroids, subjects underwent additional treatment modalities including plasmapheresis, intravenous immunoglobulins, and rituximab. Evaluation of immediately documented outcomes at discharge revealed a noteworthy recovery rate: 60% of subjects showed improvement (43.3% partial recovery and 16.7% complete recovery). This contrasted with the findings of Chinnappan et al.,[11] where a mere 33% of subjects demonstrated recovery with limited or no residual effects.

In the current investigation, two subjects were identified with COVID-19. Both subjects underwent intravenous methylprednisolone

S. No.	mRS score before	mRS score present	mRS difference	Outcome
1	5	2	3	Improved
2	4	1	3	Improved
3	5	2	3	Improved
4	2	1	1	Improved
5	5	5	0	No change
6	5	5	0	No change
7	4	0	4	Improved
8	5	0	5	Improved
9	4	1	3	Improved
10	2	0	2	Improved
11	2	0	2	Improved
12	4	0	4	Improved
13	3	1	2	improved
14	4	1	3	Improved
15	3	1	2	Improved
16	2	1	1	Improved
17	4	3	1	improved
18	1	0	1	Improved
19	4	1	3	Improved
20	2	1	1	Improved
21	4	3	1	Improved
22	5	LTF	N/A	N/A
23	5	LTF	N/A	N/A
24	5	0	5	Improved
25	4	0	4	Improved
26	5	LTF	N/A	N/A
27	5	6	N/A	DEATH
28	4	LTF	N/A	N/A
29	4	LTF	N/A	N/A
30	5	5	0	No change

Table 4: Comparison of baseline characteristics and clinical presentations based on various late outcomes (*n*, row%)

Late outcome (n = 24)	*Completely improved (7, 23.33%)*	*Partially improved (8, 26.67%)*	*No change (5, 16.67%)*	*Worsened (2, 6.67%)*	*New symptoms (2, 6.67%)*
Onset					
Acute (15, 62.5%)	4/15 (26.68%)	5/15 (33.33%)	2/15 (13.33%)	2/15 (13.33%)	2/15 (13.33%)
Subacute (9, 37.5%)	3/9 (33.33%)	3/9 (33.33%)	3/9 (33.33%)	0/9 (0%)	0/9 (0%)
Gender					
Male (12, 50%)	3/12 (25%)	6/12 (50%)	1/12 (8.33%)	1/12 (8.33%)	1/12 (8.33%)
Female (12, 50%)	4/12 (33.33%)	2/12 (16.67%)	4/12 (33.33%)	1/12 (8.33%)	1/12 (8.33%)
MRI findings (*n* = 23)*					
SSTM (6, 26.08%)	4/6 (66.66%)	1/6 (16.67%)	1/6 (16.67%)	0/6 (0%)	0/6 (0%)
LETM (16, 69.56%)	3/16 (18.75%)	6/16 (37.5%)	3/16 (18.75%)	2/16 (12.5%)	2/16 (12.5%)
LETM + Brain demyelination (1, 4.34%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	0/1 (0%)	0/1 (0%)
Weakness					
Paresis (18, 75%)					
Para (13, 54.16%)	4/13	5/13	2/13	1/13	1/13
Quadri (2, 8.33%)	1/2	0/2	0/2	0/2	1/2
One-sided (3, 12.5%)	2/3	0/3	1/3	0/3	0/3
Plegia (6, 25%)					
Para (5, 20.83%)	0/5	3/5	2/5	0/5	0/5
One-sided (1, 4.16%)	0/1	0/1	0/1	1/1	0/1
Infection					
None (16, 66.67%)	5/16 (31.25%)	4/16 (25%)	3/16(18.75%)	2/16 (12.5%)	2/16 (12.5%)
Postinfectious (6,25%)	2/6 (33.33%)	3/6 (50%)	1/6 (16.67%)	0/6 (0%)	0/6 (0%)
COVID-19 (2, 8.33%)	0/2 (0%)	1/2 (50%)	1/2 (50%)	0/2 (0%)	0/2 (0%)
CSF cell count (*n* = 20)					
Normal (17, 85%)	4/17 (23.5%)	8/17 (47.1%)	4/17(23.5%)	1/17 (5.9%)	0/17 (0%)
Abnormal (3, 15%)	2/3 (66.7%)	0/3 (0%)	1/3(33.3%)	0/3 (0%)	0/3 (0%)
CSF protein (*n* = 20)					
Normal (10, 50%)	3/10 (30%)	4/10 (40%)	2/10 (20%)	1/10 (10%)	0/10 (0%)
Raised (10, 50%)	3/10 (30%)	4/10 (40%)	3/10 (30%)	0/10 (0%)	0/10 (0%)

*MRI was not done in one subject who was found to be partially improved at follow-up; One-sided (brown-Sequard-like), unilateral complete loss of power in upper and lower limbs

Table 5 : Comparison of baseline characteristics and clinical presentations based on status of improvement at follow-up (*n*, row%)

Status of improvement at follow-up	*Improved (15, 62.5%)*	*Not improved (5, 16.67%)*
Onset (*n* = 20)		
Acute (11, 55%)	9/11 (81.81%)	2/11 (18.18%)
Subacute (9, 45%)	6/9 (66.67%)	3/9 (33.33%)
Gender (*n* = 20)		
Male (10, 50%)	9/10 (90%)	1/10 (10%)
Female (10, 50%)	6/10 (60%)	4/10 (40%)
MRI findings (*n* = 19)*		
SSTM (6, 31.57%)	5/6 (83.33%)	1/6 (16.67%)
LETM (12, 63.15%)	9/12 (75%)	3/12 (25%)
LETM + Brain demyelination (1, 5.26%)	0/1 (0%)	1/1 (100%)
Weakness (*n* = 20)		
Paresis (15, 75%)		
Para (11, 55%)	9/11 (81.8%)	2/11 (18.2%)
Quadri (1, 5%)	1/1 (100%)	0/1 (0%)
One-sided (3, 15%)	2/3 (66.67%)	1/3 (33.33%)
Plegia (5, 25%)		
Para (5, 25%)	3/5 (60%)	2/5 (40%)
Infection (*n* = 20)		
None (12, 60%)	9/12 (75%)	3/12(%)
Postinfectious (6, 30%)	5/6 (83.33%)	1/6 (16.67%)
COVID-19 (2, 10%)	1/2 (50%)	1/2 (50%)
CSF cell count (*n* = 19)		
Normal (16, 84.2%)	12/16 (75%)	4/16 (25%)
Abnormal (3, 15.8%)	2/3 (66.67%)	1/3 (33.33%)
CSF protein (*n* = 19)		
Normal (9, 47.4%)	7/9 (77.77%)	2/9 (22.23%)
Raised (10, 52.6%)	7/10 (70%)	3/10 (30%)

*MRI was not done in one subject who was found to be improved at follow-up

Table 6: Comparison of initial and final mRS scores in subjects with various antibodies

Positive serology	*Initial mRS*	*Final mRS*	*mRS change*
CENP-b+ANA Antibodies	4	1	Partially improved
SSA antibodies	5	5	Not improved
Anti-histone antibodies	5	2	Partially improved
ANA antibodies (a*)	4	1	Partially improved
ANA antibodies (b*)	4	0	Completely improved
MOG antibodies	3	1	Partially improved

*The two subjects positive for ANA antibodies are addressed as "a" and "b" in this table

Table 7: Comparison of initial and final mRS scores based on site of spinal lesion (n = 23)

Site of lesion in the spinal cord	*mRS improved (20)*	*mRS not improved (3)*
Cervical (5)	5 (100%)	0
Thoracic (12)	10 (83.33%)	2 (16.67%)
Cervical and thoracic (4)	4 (100%)	0
Thoracic to lumbar (2)	1 (50%)	1 (50%)

The subject in whom an MRI was not done also showed an mRS score improvement

Table 8: Initial outcomes versus outcomes at follow-up

Outcome at follow-up	*Completely improved (7, 28.16%)*	*Partially improved (8, 33.33%)*	*No change from initial outcome (5, 20.83%)*	*Worsened (2, 8.33%)*	*New symptoms (2, 8.33%)*
Initial outcome					
Partially improved (12)	3 (25%)	6 (50%)	1 (8.3%)	1 (8.3%)	1 (8.3%)
Completely improved (5)	4 (80%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)
No change (7)	0 (0%)	2 (28.6%)	4 (57.1%)	1 (14.3%)	0 (0%)

Lost to follow-up = 5, death =1

administration at a dosage of 1000 mg. The initial presentation of the first subject was characterized by partial improvement, which persisted during follow-up. Conversely, the second subject showed no initial improvement but demonstrated partial improvement on subsequent assessment. Unfortunately, the absence of COVID-19 cerebrospinal fluid polymerase chain reaction (CSF PCR) testing precluded establishing a definitive link between COVID-19 spinal infection and TM.

Studies conducted by Doi et al.,[12] Chow et al.,[13] and Gudlavalleti et al.[2] have reported cases of acute-onset TM associated with COVID-19, presenting with sensory loss, diminished muscle strength, hyperreflexia, and involvement of bowel and bladder function. Importantly, these manifestations were identified as post-infectious and post-vaccination sequelae of COVID-19, and notably, they exhibited favorable responses to intravenous steroid therapy.

An examination of the trajectory of outcomes during the final follow-up, contingent upon the initial outcomes, revealed that 46.2% of participants exhibiting initial partial improvement maintained a status quo, while 23% experienced complete resolution. Conversely, 20% of those initially demonstrating complete improvement manifested new symptoms at the final follow-up. Notably, among the cohort of 12 subjects who displayed no initial improvement, 33.3% exhibited a persistently unaltered condition, 16.7% demonstrated partial improvement, and 8.3% experienced a deterioration in symptoms.

The majority of individuals diagnosed with idiopathic TM typically undergo at least partial recovery, a restorative process typically commencing within a span of one to three months. Continued improvement is observed through the implementation of exercise and rehabilitation therapy, with the potential for recovery extending over several years. Notably, Defresne et al.[8] reported that around 40% of patients sustained some level of disability despite the recovery process.

Conclusion

Acute onset LETM cases can potentially convert to Multiple Sclerosis. Patients who show early improvement, whether partial or complete, have higher chances of complete recovery at follow-up.

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