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GOAL-ORIENTED PHYSIOTHERAPY FOR FUNCTIONAL RESTORATION IN LONGITUDINALLY EXTENSIVE TRANSVERSE MYELITIS: AN ICF-BASED CASE REPORT

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ABSTRACT

Background

Longitudinally extensive transverse myelitis (LETM) is a rare inflammatory disorder of the spinal cord characterized by lesions extending across three or more vertebral segments, often resulting in severe neurological deficits. Individuals typically present with rapid onset of bilateral motor weakness, sensory disturbances, impaired trunk control, and autonomic dysfunction, including bowel and bladder involvement. Early multidisciplinary rehabilitation is essential to minimize complications and enhance functional recovery. This case report describes the effectiveness of a goal-oriented physiotherapy intervention guided by the International Classification of Functioning, Disability and Health (ICF) framework in improving functional outcomes in a patient

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with LETM. A structured physiotherapy program was initiated alongside medical management, focusing on prevention of bed-rest complications, maintenance of joint range of motion, improvement of muscle strength, and sensory re-education. The intervention included breathing exercises, passive and active range of motion exercises, grip strengthening, bed mobility and transfer training, Frenkel's exercises, and progressive sitting, standing, and balance activities tailored to the patient's functional goals. Following the intervention, the patient demonstrated gradual improvements in muscle strength, postural control, and balance. Enhanced participation in activities of daily living and increased functional independence were observed upon reassessment. These findings highlight the importance of early, individualized, and goal-oriented physiotherapy in the rehabilitation of LETM, contributing significantly to functional recovery, independence, and overall quality of life.

Keywords

Longitudinally extensive transverse myelitis, goal-oriented physiotherapy, balance, functional restoration, ICF, rehabilitation

INTRODUCTION

Longitudinally extensive transverse myelitis (LETM) is a neurological disorder caused by inflammation of the spinal cord across one or more vertebral segments on magnetic resonance imaging [1]. The inflamed spinal cord causes damage to the myelin sheath, leading to acute disruption of motor, sensory, and autonomic pathways. This damage interrupts signal transmission between the spinal cord and the brain, resulting in

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bilateral limb weakness, sensory disturbances, and bowel and bladder dysfunction, which significantly impact functional abilities and quality of life [2].

LETM may occur as an idiopathic condition or secondary to post-infectious processes, systemic inflammatory diseases (e.g., Neuromyelitis Optica spectrum disorder, multiple sclerosis), or other central nervous system disorders [3]. The onset is often acute or subacute, with symptoms evolving over hours to days. Recovery trajectories vary widely among individuals; approximately one-third of patients achieve near-complete recovery, one-third sustain moderate disability, and the remaining one third experience significant long-term impairments [4].

The ICF framework provides a comprehensive model for understanding the impact of TM across three domains: body functions and structures, activities, and participation. Applying this framework guides structured, goal-oriented rehabilitation targeting the specific impairments and activity limitations of each patient [5].

Early and structured rehabilitation integrating range of motion exercises, strength training, gait and balance re-education, and functional task training is considered crucial in mitigating secondary complications, enhancing neurological function, and promoting activity participation. This case report aims to contribute to the limited evidence by describing the clinical presentation and goal-oriented physiotherapy intervention applied in a patient with longitudinally extensive transverse myelitis, with emphasis on functional outcomes and rehabilitation strategies.

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CASE DESCRIPTION

A 20-year-old right-hand dominant female presented with complaints of acute onset weakness involving both upper and lower limbs, with predominant involvement of the lower limbs, associated with neck pain, sensory paresthesia, urinary retention, and difficulty in performing activities of daily living. Symptoms had been present for 8days prior to admission.

Neurological symptoms progressed rapidly to involve the trunk and upper limbs within 12 hours of onset, accompanied by urinary retention requiring urinary catheterization. On examination, the patient was conscious, oriented, and hemodynamically stable. Neurological assessment revealed generalized quadriparesis, reduced muscle tone in the lower limbs, diminished deep tendon reflexes, impaired balance, and sensory disturbances, with no cranial nerve involvement or muscle wasting. Gait could not be assessed initially due to inability to stand independently.

Cerebrospinal fluid (CSF) analysis showed lymphocytic pleocytosis, suggestive of an inflammatory process. MRI of the spine revealed longitudinally extensive T2 hyperintense intramedullary signal changes from C3–T1. Based on clinical features and investigative findings, and after exclusion of Guillain–Barré syndrome (GBS), a diagnosis of acute longitudinally extensive transverse myelitis (LETM) was established.

The patient received high-dose intravenous methylprednisolone (1 g/day for 5 days) and supportive medical management, including co-trimoxazole (Septran DS) for pneumocystis prophylaxis during steroid therapy. Physiotherapy assessment identified significant impairments in muscle strength, range of motion, balance, and functional

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independence, following which a goal-oriented physiotherapy rehabilitation program was initiated on 16thOctober 2025 Day of admission.

CLINICAL FINDINGS

Table 1: Clinical Findings of a Patient with Longitudinally Extensive Transverse Myelitis

Clinical Domain	Findings
Neurological Examination	Acute quadriparesis with predominant lower limb weakness; decreased tone in bilateral lower limbs; diminished deep tendon reflexes; sensory paresthesia
Functional Assessment Tools	Manual Muscle Testing (MMT) — Baseline score: 1/5 for bilateral upper and lower limbs; Barthel Index — Baseline score: 10/100; Berg Balance Scale (BBS) — Baseline score: 1/56
Laboratory Findings	CSF analysis: lymphocytic pleocytosis, suggestive of inflammatory process
Radiological Findings	MRI spine: longitudinally extensive T2 hyperintense intramedullary signal changes from C3-T1
ENMG (Electroneuromyography)	Bilateral median, ulnar, common peroneal, and posterior tibial motor conductions within normal limits, including F-wave. (Performed to exclude Guillain–Barré syndrome.)

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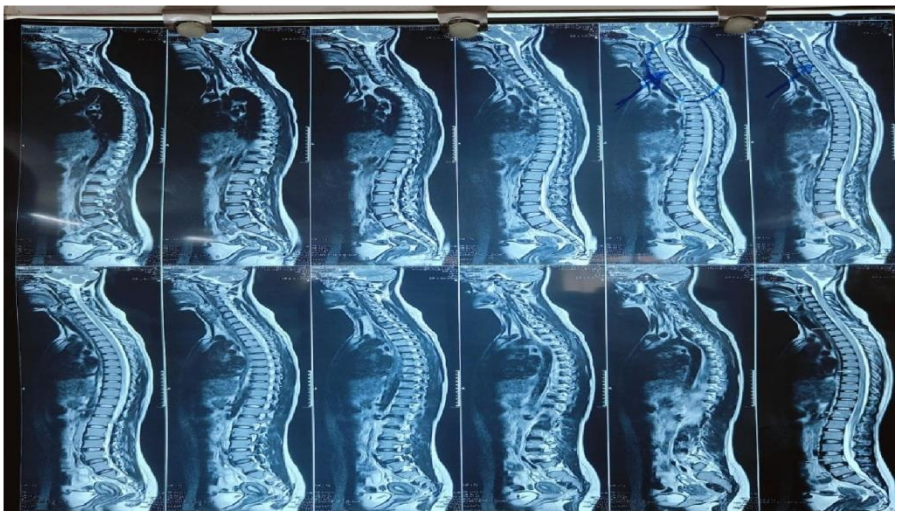
EEG (Electroencephalography)	Resting and sleep EEG: abnormal — excess theta activity with intermittent bursts of generalized frontally dominant delta slow waves. [Clinical justification for EEG must be stated in text — EEG is not routinely indicated in TM unless encephalopathy or seizures are suspected.]
Clinical Diagnosis	Longitudinally Extensive Transverse Myelitis (LETM)
Medical Management	Injection Methylprednisolone 1 g IV pulse doses; Tablet Co-trimoxazole (Sept ran DS) 1-0-1 (for pneumocystis prophylaxis during steroid therapy)

RADIOLOGICAL FINDINGS

Figure-1 Radiological image of patient



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PHYSIOTHERAPY ASSESSMENT AND GOAL SETTING

ICF FRAMEWORK APPLICATION

The International Classification of Functioning, Disability and Health (ICF) framework was used to guide assessment and goal setting in this case. The patient's condition was analyzed across three core domains as outlined below.

Table 2: ICF-Based Assessment

ICF Domain	Impairments / Limitations	Rehabilitation Goals
Body Functions & Structures	Quadriparesis, hypotonia (bilateral LL), diminished DTRs, sensory paraesthesia, urinary retention	Improve muscle strength (target MMT ≥3/5), restore sensory perception, prevent secondary complications
Activity	Unable to perform bed mobility, transfers, sit-to-stand, ADLs independently; Berg Balance Scale 1/56	Achieve independent bed mobility and sitting balance; improve Berg Balance Scale score; improve Barthel Index
Participation	Unable to participate in self-care, domestic activities, social interaction due to complete functional dependency	Return to age-appropriate functional independence; improve quality of life

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PHYSIOTHERAPY INTERVENTIONS

Table 3: Physiotherapy Intervention Protocol

Therapeutic Intervention	Dosage	Duration per Session	Outcome Measure
Range of Motion (ROM) Exercises	10 repetitions / 3 sets	15 minutes	Goniometry
Sensory Re-education	5–10 repetitions / 3 sets (hold: 3–5 seconds)	[Specify session duration]	Sensory Examination (light touch, proprioception)
Strength Training	10 repetitions / 3 sets	15 minutes	Manual Muscle Testing (MMT) / MRC Scale
Grip Strength Training	10–15 repetitions / 3 sets	15 minutes	Functional Hand Assessment
Balance and Coordination Exercises	15 repetitions / exercise	15 minutes	Berg Balance Scale; Coordination Tests
Functional Re-education	5–10 repetitions / task	30 minutes	Barthel Index
Task-Specific Exercise	7 repetitions / task	20 minutes	Barthel Index

OUTCOMES AND RESULTS

Outcome measures were assessed at baseline (Week 1) and upon completion of the rehabilitation program (Week 4) to document changes in muscle strength, balance, and functional independence. As this is an exploratory single-case study, results are reported descriptively without inferential statistics.

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Table 4: Upper and Lower Limb Function (Baseline vs. Discharge)

Outcome Measure	Baseline (Week 1)				Discharge (Week 4)			
	Upper Limb		Lower Limb		Upper Limb		Lower Limb	
	Right	Left	Right	Left	Right	Left	Right	Left
Muscle Tone (MAS)	0	0	Hypotonia	Hypotonia	0	0	1	1+
MMT Score	1/5–2/5	1/5–2/5	1/5	1/5	3/5	3/5	3/5	3/5
Sensory Examination	2 (Normal)	2 (Normal)	1 (Diminished)	1 (Diminished)	2 (Normal)	2 (Normal)	2 (Normal)	2 (Normal)
Coordination	Fair	Fair	NT*	NT*	Good	Good	Fair	Fair

Sensory grading score according to ASIA sacle;0- absent ;1- diminished ;2- normal; NT-Not testable

Table 5: Functional Outcome Measures (Baseline vs. Discharge)

S. No.	Outcome Measure	Pre-Intervention (Week 1)	Post-Intervention (Week 4)
1	Berg Balance Scale	1/56 (Profound impairment; high fall risk)	34/56 (Moderate balance; reduced fall risk)
2	Barthel Index	10/100 (Total/Severe dependency)	70/100 (Mild dependency)

The Berg Balance Scale score improved from 1/56 at baseline — representing profound balance impairment and high risk of falls — to 34/56 at discharge, indicating improved postural stability and balance control. Functional assessment using the Barthel Index showed an increase from 10/100 preintervention, indicating severe dependency in

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activities of daily living, to 70/100 post-intervention, reflecting a transition to mild dependency. These quantitative improvements underscore the effectiveness of goal-oriented physiotherapy in improving functional performance in a patient with transverse myelitis.

DISCUSSION

Longitudinally extensive transverse myelitis is defined radiologically as a spinal cord lesion extending over three or more contiguous vertebral segments on MRI [6]. It is most commonly associated with autoimmune etiologies and other inflammatory demyelinating conditions [7].

This study highlights the functional severity of longitudinally extensive transverse myelitis and the role of goal-oriented physiotherapy in promoting the recovery. Due to extensive tract involvement individuals with LETM commonly present with functional limitations during the acute stage of disease [8].

Although rehabilitation is a key component in spinal cord injury management, longitudinally extensive transverse myelitis presents unique challenges due to fluctuating neurological recovery and autonomic involvement, which may restrict early therapeutic engagement [9].

In the present case, implementation of an early, goal-oriented physiotherapy program resulted in notable improvements in balance and functional performance, as reflected by gains in Berg Balance Scale and Barthel Index scores. The Berg Balance Scale improved from 1/56 to 34/56, and the Barthel Index improved from 10/100 to 70/100. These improvements indicate enhanced postural control and reduced dependence in activities of daily living. Similar findings have been reported in earlier studies

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emphasizing the role of individualized physiotherapy in improving functional outcomes in inflammatory spinal cord disorders [10].

The rehabilitation approach in this case emphasized prevention of secondary complications, facilitation of motor recovery, enhancement of trunk stability, and task-specific functional training. Evidence suggests that such targeted interventions promote neuromuscular re-education and functional adaptation, thereby improving overall mobility and independence [11]. Previous literature also supports the use of adjunctive techniques such as positioning strategies, cryotherapy, stretching, and soft tissue mobilization to address tone abnormalities and movement restrictions in inflammatory myelopathies.

Overall, this case demonstrates that structured, individualized physiotherapy initiated during the acute phase can play a pivotal role in functional restoration following transverse myelitis. Given the absence of standardized rehabilitation guidelines, this report contributes to existing literature by highlighting the potential benefits of goal-oriented, ICF-guided rehabilitation strategies. Further longitudinal and controlled studies are needed to establish optimal physiotherapy protocols and improve long-term outcomes in individuals with transverse myelitis.

As this is a single case report, certain limitations must be acknowledged. The findings cannot be generated to the broader population due to absence of control group and the small sample size. Additionally spontaneous neurological recovery following medical management may have contributed to the observed improvements. The short follow up duration also limits understanding of long-term sustainability of functional gains.

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CONCLUSION

This case report demonstrates that early, goal-oriented physiotherapy contributed to improved balance and functional independence in a patient with longitudinally extensive transverse myelitis. The application of the ICF framework facilitated a structured, patient-centered approach to goal setting and intervention planning. These findings highlight the importance of individualized rehabilitation strategies and support the integration of structured physiotherapy into the comprehensive management of transverse myelitis. Future studies with larger sample sizes and controlled designs are needed to establish standardized rehabilitation protocols.

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