

Effect of Physiotherapy Intervention on Functional Outcomes in a Patient with Neuromyelitis Optica: A Case Report

Dr. Saurabh Pravin Mahajan (PT)¹, Dr. Komal Gunjal (PT) PhD²

¹Post Graduate Student, Master's in Physiotherapy (Neurosciences), Department of Neuro Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences (DU), Loni, Maharashtra, India
Corresponding Author Email: mahajansaurabh1011[at]gmail.com

²Associate Professor, Department of Neuro Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences (DU), Loni, Maharashtra, India
Email: komal.thorat[at]pmpimps.org

Abstract: Introduction: Neuromyelitis optica (NMO), now included within neuromyelitis optica spectrum disorder (NMOSD), is an autoimmune inflammatory disorder of the central nervous system that may cause severe motor, sensory and autonomic dysfunction. Physiotherapy plays an important role in maintaining mobility, preventing secondary complications and improving functional independence. Case Report: A 41-year-old female diagnosed with neuromyelitis optica with gastrocolitis presented with approximately one month of bilateral lower-limb weakness and difficulty standing, associated with burning and difficulty during micturition and reduced bowel and bladder control. Examination revealed severe bilateral lower-limb weakness, impaired lower-limb coordination, altered standing balance and reduced trunk strength. Serum NMO antibody was positive. The Berg Balance Scale (BBS) and Expanded Disability Status Scale (EDSS) were used as outcome measures. Intervention: An individualized 8-week neurophysiotherapy program was provided, consisting of patient and caregiver education, prevention of secondary complications, range-of-motion exercises, neuromuscular facilitation, strengthening, core exercises, balance and coordination training, bowel and bladder management, aerobic conditioning and progressive gait training. Results: Following rehabilitation, the BBS score improved from 4/56 to 47/56 and the EDSS score improved from 8.5/10 to 3.0/10. Clinically, the patient progressed from severe difficulty with standing and mobility to substantially improved standing balance and functional ambulation. Conclusion: This case highlights the potential benefits of individualized and progressive neurophysiotherapy in improving balance and functional mobility in a patient with NMO. Structured rehabilitation with gradual progression and prevention of secondary complications may contribute to improved functional independence.

Keywords: Neuromyelitis Optica, Neuromyelitis Optica Spectrum Disorder, Physiotherapy, Neurorehabilitation, Balance, Gait

1. Introduction

Neuromyelitis optica (NMO) is an autoimmune inflammatory disorder of the central nervous system predominantly affecting the optic nerves and spinal cord. The term neuromyelitis optica spectrum disorder (NMOSD) encompasses a broader group of clinical presentations associated with characteristic neurological manifestations and disease-specific antibodies.¹

Spinal cord involvement in NMOSD may result in severe motor weakness, sensory disturbances, impaired balance, gait dysfunction and bowel and bladder disturbances. These impairments can significantly affect mobility and independence, particularly during acute or subacute episodes.

Although pharmacological management is essential for controlling disease activity, rehabilitation is important for addressing the functional consequences of neurological impairment. Previous studies have reported improvements in disability, motor function, balance, walking and bowel and bladder function following multidisciplinary rehabilitation in patients with NMOSD.²⁻⁵

Nishikawa et al. reported a supervised physical therapy program performed five days per week for 60 minutes in a patient with acute NMO, including strengthening, standing and progressive gait training.³ Suo et al. also demonstrated

potential benefits of multidisciplinary rehabilitation performed five times per week in patients with moderate-to-severe NMOSD disability.²

The present case describes the functional changes following an individualized 8-week neurophysiotherapy program in a patient with NMO presenting with severe bilateral lower-limb weakness, impaired balance and bowel and bladder dysfunction.

2. Case Report

A 41-year-old female housewife from Loni, Maharashtra, was admitted to Pravara Medical Trust Hospital on **28 January 2025** and assessed by physiotherapy on **29 January 2025**. She was right-side dominant.

The patient presented with **bilateral lower-limb weakness and difficulty standing for approximately one month**. She also reported burning and difficulty during micturition with reduced bowel and bladder control. Nausea, vomiting and occasional bloody stools were also reported.

According to the history, the patient was functionally well approximately one month before presentation, after which she developed progressive weakness in both lower limbs accompanied by urinary symptoms. She initially presented to the hospital for further evaluation but was subsequently taken

by her relatives to another hospital, where further investigations and treatment were performed. Following discharge, she was readmitted to Pravara Medical Trust Hospital for further management.

Her past medical history included **type 2 diabetes mellitus**, and she had undergone hysterectomy approximately four months before the present admission. An indwelling urinary catheter was present at the time of assessment.

3. Clinical Findings

On examination, the patient was conscious and alert and oriented to time, place and person. Vital signs in supine lying were: heart rate 80 beats/min, blood pressure 130/80 mmHg, respiratory rate 20 cycles/min and SpO₂ 98%. She was afebrile.

Cranial nerve examination and higher mental functions were intact. Superficial sensations were preserved, while joint vibration was diminished and graphesthesia was affected.

Marked weakness was present in both lower limbs. Hip flexors, extensors, abductors and adductors were graded **1/5 bilaterally**, while knee flexors and extensors were also graded **1/5**. Ankle dorsiflexors and plantar flexors were graded **2+/5**, while inversion and eversion were **2-/5** bilaterally. Abdominal strength was 3/5 and trunk extensor strength was 2/5.

Upper-limb strength was relatively preserved, with shoulder movements approximately 4+/5 and elbow and wrist movements approximately 4/5 bilaterally.

Lower-limb coordination was impaired, with heel-to-shin testing graded 0. Standing balance was markedly affected, and the patient was initially unable to perform feet-apart standing, feet-together standing, single-leg standing or tandem activities. The initial BBS score was **4/56**, indicating a high risk of falls.

Table 1: Selected clinical findings at initial assessment

Parameter	Finding
Hip muscle strength	1/5 bilaterally
Knee flexors/extensors	1/5 bilaterally
Ankle dorsiflexors/ plantar flexors	2+/5 bilaterally
Ankle invertors/evertors	2-/5 bilaterally
Abdominal strength	3/5
Trunk extensor strength	2/5
Lower-limb coordination	Impaired
Sitting balance	Intact
Standing balance	Impaired
BBS	4/ 56
Gait	Initially not clinically assessable

4. Investigations and Diagnosis

MRI demonstrated few ischemic foci involving the subcortical and periventricular white matter of the bilateral frontoparietal lobes, grade I anterolisthesis at L4–L5, mild posterior disc bulges at C2–C7 and L4–L5, Modic changes at L4–L5 and altered signal intensity in the D7 vertebral body suggestive of focal fatty marrow/haemangioma.

Ultrasonography of the abdomen and pelvis was suggestive of gastrocolitis, mainly significant gastritis, with borderline hepatomegaly and grade I fatty changes in the liver.

Serum NMO antibody testing was **positive**, supporting the documented diagnosis of neuromyelitis optica.

The final documented diagnosis was **Neuromyelitis Optica with gastrocolitis**.

5. Outcome Measures

The **Berg Balance Scale (BBS)** was used to assess functional balance. The scale has a maximum score of 56, with lower scores indicating greater balance impairment and fall risk.

The **Expanded Disability Status Scale (EDSS)** was used to document overall neurological disability.

The outcome measures were recorded before and after the rehabilitation program.

6. Physiotherapy Intervention

An individualized **8-week neurophysiotherapy program** was provided. The major goals were to improve lower-limb motor control and strength, balance, coordination, trunk function and mobility while preventing secondary complications and addressing bowel and bladder dysfunction.

The intervention consisted of patient and family education, prevention of secondary complications, range-of-motion exercises, neuromuscular facilitation, strengthening, core exercises, balance training, bowel and bladder management, aerobic conditioning and progressive gait training.

The overall frequency of supervised rehabilitation was approximately **five days per week for 60 minutes per session**. This frequency was informed by previous NMOSD rehabilitation literature, particularly the protocol reported by Nishikawa et al., in which physical therapy was performed five days per week for 60 minutes.³ Suo et al. also reported multidisciplinary rehabilitation five times per week in patients with moderate-to-severe NMOSD disability.²

The program was progressed according to the patient's functional recovery and tolerance rather than following a rigid protocol.

Table 2: Eight-week physiotherapy rehabilitation program

Goal	Intervention	Progression
Prevent secondary complications	Positioning, pressure relief, ROM and mobility	Progressive mobilization
Improve lower-limb strength	Active-assisted exercises, isometrics, strengthening and NMES/FES	Progression according to voluntary motor control
Improve trunk control	Abdominal activation, bridging and trunk exercises	Progression toward functional trunk control
Improve balance	Sit-to-stand, supported standing and weight shifting	Reduced assistance and dynamic balance

Improve coordination	Lower-limb coordination activities	Functional standing and gait activities
Bowel/bladder management	Education and functional management strategies	Greater patient participation
Improve aerobic capacity	Spot marching and treadmill activity as tolerated	Gradual increase in duration/intensity
Improve gait	Parallel-bar gait with assistance	Walker and subsequent cane progression
Education	Patient/caregiver education and home program	Independent self-management

Previous rehabilitation reports in NMOSD have similarly incorporated strengthening, standing, balance, transfer and gait training.²⁻⁵

7. Results

Following completion of the 8-week rehabilitation program, substantial improvement was observed in functional balance and neurological disability.

Table 3: Pre- and post-rehabilitation outcome measures

Outcome Measure	Pre-rehabilitation	Post-rehabilitation
Berg Balance Scale	Apr-56	47/56
EDSS	8.5/10	3.0/10

The BBS improved by **43 points**, from 4/56 to 47/56. The EDSS improved from **8.5/10 to 3.0/10**.

The patient demonstrated clinically meaningful improvement in standing balance and mobility, progressing from severe limitations in standing and walking to substantially improved functional ambulation.

Because this was a single-case report, no inferential statistical analysis was performed.

8. Discussion

This case demonstrates the functional changes observed following an individualized neurophysiotherapy program in a patient with NMO who presented with severe bilateral lower-limb weakness, impaired coordination, poor standing balance and bowel and bladder dysfunction.

The most notable change was observed in the BBS, which increased from 4/56 to 47/56. The improvement occurred alongside progressive strengthening, trunk training, balance activities, transfer practice and gait training.

The findings are consistent with previous rehabilitation literature in NMOSD. Suo et al. reported improvements in EDSS and bowel, bladder and motor functions following multidisciplinary rehabilitation performed five times per week in patients with moderate-to-severe NMOSD disability.²

Nishikawa et al. described a patient with acute NMO who received physical therapy five days per week for 60 minutes, including strengthening, standing exercises, electrical muscle stimulation and progressive gait training. The patient's EDSS

improved from 9.0 to 6.0 without worsening of symptoms during hospitalization.³

Kim et al. also reported improvement in strength and functional performance following rehabilitation in two patients with NMO, supporting the importance of strengthening and functional mobility training in this population.⁴

More recent evidence from a prospective cohort study of patients with acute NMOSD has also reported improvements in EDSS, balance, motor function and activities of daily living following rehabilitation exercise.⁵

In the present case, the rehabilitation program was therefore designed to address both impairment-level and activity-level limitations. Strengthening and neuromuscular facilitation were used to improve voluntary lower-limb activation, while trunk and balance training were incorporated to facilitate progression toward functional standing and gait.

Gait training was gradually progressed from supported activities to assistive-device-based ambulation. This approach is consistent with the progressive gait rehabilitation described in previous NMO case literature.³

Bowel and bladder dysfunction was another important component of the patient's presentation. Multidisciplinary rehabilitation studies in NMOSD have demonstrated improvement in bowel and bladder functional domains, supporting the inclusion of these problems within the rehabilitation plan rather than focusing exclusively on motor impairments.²

The improvement in EDSS from 8.5 to 3.0 represents a substantial change in overall neurological disability. However, this finding should be interpreted cautiously because the patient received concurrent medical treatment and neurological recovery following an acute episode may occur independently of rehabilitation. Therefore, this case cannot establish that physiotherapy alone caused the observed improvement.

Nevertheless, the case emphasizes the importance of structured and progressive rehabilitation for patients with severe NMO-related disability. A comprehensive program addressing strength, balance, mobility, autonomic dysfunction, prevention of secondary complications and functional independence may help maximize recovery.

9. Limitations

The major limitation of this report is that it describes a **single patient**, and the findings cannot be generalized to all patients with NMOSD.

There was no control group, and the patient received concurrent medical management. Therefore, the individual contribution of physiotherapy to the observed recovery cannot be determined.

Long-term follow-up was also not available to establish whether the functional improvements were maintained.

10. Conclusion

An individualized 8-week neurophysiotherapy program was associated with marked improvement in balance and overall functional status in a patient with neuromyelitis optica presenting with severe bilateral lower-limb weakness.

The BBS improved from 4/56 to 47/56, while the EDSS improved from 8.5/10 to 3.0/10. The case highlights the importance of progressive strengthening, balance and gait training, prevention of secondary complications and functional rehabilitation in patients with severe NMO-related disability.

Although causality cannot be established from a single case, this report supports the potential role of structured neurophysiotherapy as an important component of multidisciplinary management of NMOSD.

Declarations

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Saurabh Mahajan

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