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A CASE REPORT: REHABILITATION IN A MIDDLE-AGED WOMAN AFTER ACUTE NON-HEMORRHAGIC CEREBELLAR INFARCTION WITH HYDROCEPHALUS

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ABSTRACT

BACKGROUND: Cerebellar strokes make up about 2–3% of all ischemic strokes. Acute cerebellar stroke can cause serious neurological symptoms like ataxia, dysmetria, dysdiadochokinesia, and truncal instability, but they rarely result in aphasia or hemiplegia.

CASE DESCRIPTION: A 41-year-old female patient presented to our department with complaints of difficulty walking and transferring, challenges in performing daily activities (bathing, eating, grooming, cooking, chopping, and mopping), as well as dysphagia and slurred speech following a cerebrovascular accident.

EXAMINATION: Neurological examination revealed significant in-coordination, balance impairment, dysarthria, and swallowing difficulties without significant motor weakness. We assessed the patient with MMSE (Mini Mental Status Examination), FIM (Functional independency measure), ISS (Indian Stroke Scale), BBS (Berg Balance scale), SARA (The Scale for the Assessment and Rating of Ataxia), 6MWD (Six Minute Walk Distance), and FIST (Function In Sitting Test).

PHYSIOTHERAPY INTERVENTION: Physiotherapy management was provided 5 days a week for 12-week, progression was done every 1 to 2 weeks as needed according to the therapist to keep the activity challenging.

DISCUSSION: All the parameters showed improvement after 12 weeks of intervention. We also assessed the patient after 1 month for follow-up and we found that almost all the parameters were either same or had improved suggesting the efficacy of management and transfer of skill at home environment. Conclusion: - This case report demonstrates that tailored made individual specific exercise protocol with regular counselling can lead to improvement in a Post non-haemorrhagic acute stroke with hydrocephalus.

KEYWORD: Cerebellar Ataxia, Hydrocephalus, Rehabilitation, Physiotherapy, Independency.

INTRODUCTION

Acute non-hemorrhagic cerebellar infarction is a serious neurological condition that may occur due to minor head injury, vascular occlusion, and systemic risk factors. Cerebellar strokes make up about 2–3% of all ischemic strokes, and they are often missed because they do not show the usual signs on the cortex (Datar & Rabinstein, 2014). The cerebellum plays a vital role in coordinating movement, controlling posture, and keeping balance, thereby makes infarctions in this area challenging for rehabilitation.

Acute cerebellar stroke can cause serious neurological symptoms like ataxia, dysmetria, dysdiadochokinesia, and truncal instability, but they rarely result in aphasia or hemiplegia. The cerebellum's role in integrating sensory and motor information and adapting to new situations also shows how important it is to start structured physiotherapy early to make the most of neuroplasticity (Pedroso et al., 2019).

Patients with history of posterior fossa strokes are at risk of developing hydrocephalus, which can be life threating. Cytotoxic and vasogenic edema can cause mass effect in cerebellar infarctions, which can block the flow of cerebrospinal fluid (CSF), especially at the fourth ventricle or cerebral aqueduct level. This can lead to obstructive hydrocephalus (Rufus et al., 2021). Some clinical signs are a worsening headache, nausea, changes in mental status, unstable gait, and cranial nerve deficits. These can look a lot like the first signs of a stroke, making it harder to find them early.

Hydrocephalus can make rehabilitation take longer because it lowers consciousness and slows down neurological recovery. This leads to more illness, longer hospital stays, and increased dependence for daily activities. Even after surgery, like posterior fossa decompression or ventriculoperitoneal shunting, functional recovery may not be complete if rehabilitation is not started right away (Williams, 2025).

Patients with cerebellar stroke and hydrocephalus have impairment in mobility and coordination because their vestibular, visual, and proprioceptive integration is not working as well (High & Andrews, 2020). However, new research shows that physiotherapy approaches like task-specific training, and balance-oriented therapy can greatly improve recovery outcomes in these groups (Hubbard et al., 2009). Early, intensive, and personalized rehabilitation programs are very important for getting the most out of patients' abilities and becoming more independent in daily activities (Parker et al., 2013).

This case report aims to show the impact of tailored made early intensive rehabilitation protocol in a complicated Acute Non-hemorrhagic Cerebellar Infarction with Hydrocephalus case.

CASE DESCRIPTION

A 41-year-old female patient presented to our department with complaints of difficulty walking and transferring, challenges in performing daily activities (bathing, eating, grooming, cooking, chopping, and mopping), as well as dysphagia and slurred speech following a cerebrovascular accident on 28/01/2025.

History

Ten days prior to admission, the patient experienced persistent headaches, followed by 2–3 episodes of vomiting daily before 4–5 days, and worsening gait instability before 2 days, yet she was not taken to hospital. When she did not recover, they consulted a Tertiary care hospital. She received initial supportive medical management. She underwent surgery on 01/02/2025 and 03/02/2025. Postoperatively, she remained on ventilator support for 2 days, followed by a 10-day ICU stay and an 8-day stay in the general ward. She was discharged and referred for physiotherapy rehabilitation for cerebellar ataxia.

Investigational History

MRI brain (28/01/2025) suggestive of fairly large area of acute non-hemorrhagic infracts in right cerebellar hemisphere.

MRI brain (31/01/2025) screening suggest well defined abnormal signal intensity areas involving right superior cerebellum. Mass effect in form of compression over right midbrain, effacement of 4th ventricle anteriorly and resultant mild dilatation of 3rd and lateral ventricles. Subtle periventricular CSF seepage is noted. Benign basal ganglia calcification on either side.

CT BRAIN (03/02/2025) suggestive of post-operative occipital craniectomy. Right sided drainage tube noted traversing through right lateral ventricle. Well defined abnormal hypodensity involving right superior cerebellum possibility of acute infarct. Areas of acute subarachnoid hemorrhage along involved right cerebellar folia. Mass effect in form of compression over right midbrain, effacement of 4th ventricle anteriorly. As compared to previous finding, ventricular dimensions were within normal limits.

Surgical History

On 1/02/2025 patient underwent a right-sided posterior fossa decompression (occipital craniectomy) under general anesthesia following a cerebellar infarction with associated mass effect and obstructive hydrocephalus. This surgical intervention was performed to relieve intracranial pressure and decompress the brainstem structures compressed by the infarcted cerebellar tissue.

In addition, on 3/02/2025 the patient required a tracheostomy due to respiratory compromise and prolonged mechanical ventilation needs during the postoperative period.

Examination

Informed consent was obtained prior to evaluation. Previously independent in all activities of daily living, she is now dependent for mobility and self-care due to illness, with moderate cognition and bowel/bladder function. Neurological examination revealed significant in-coordination, balance impairment, dysarthria, and swallowing difficulties without significant motor weakness.

The patient demonstrated moderate cognitive impairment with stable vital signs. All cranial nerves functions were intact, and there was no sensory or perceptual deficit. On observation, the patient had a tracheostomy in place, maintained a slouched posture, and required two-person assistance for ambulation.

Muscle tone was within normal limits, reflexes were exaggerated (grade 3+), and the range of motion (ROM) of all joints was functionally preserved. Non-equilibrium test showed patient having dyssynergia, dysmetria, tremor and hypokinesia, suggesting moderate impairment (able to accomplish activity movements are slow awkward and unsteady). Equilibrium test showed moderate impairment in sitting and in ability to maintain standing without external support.

The Mini-Mental State Examination (MMSE) score was found to be 16. MMSE is a short test of cognitive abilities that looks at things like how well you can orient yourself to time and place, remember things right away, remember things for a short time, speak, and move your body. It can also get a maximum score of 30, and scores below 24 are often a sign of cognitive impairment (Bour et al., 2010).

The Functional Independence Measure (FIM) score was 69. FIM is a standardized test that measures a person's level of disability and how much help they need to do daily tasks. It covers things like self-care, controlling the sphincter, moving around, talking, and understanding social situations. The total score can be anywhere from 18 (completely dependent) to 126 (completely independent) (Itakussu et al., 2021)

The Indian Stroke Scale (ISS) score was 32. ISS is a clinical tool made just for measuring how bad a stroke is in Indian populations. It has consciousness, gaze, visual fields, facial palsy, motor function of the limbs, sensory response, and speech. It provides a simple and rapid evaluation method suitable for acute stroke settings (Prakash & Ganesan, 2021).

The Function in Sitting Test (FIST) score was 18. FIST is meant to check how well patients can balance while sitting, especially those with neurological problems. It has 14 questions that test different parts of sitting still and moving, like reaching, turning, and moving the trunk. There are 56 points possible, and each item gets a score from 0 to 4.

The Berg Balance Scale (BBS) Score was 15. BBS is a test that older people and people with neurological or musculoskeletal problems can take to see how well they can balance and how likely they are to fall. There are 14 tasks, such as standing, moving, reaching, and turning, and each one gets a score from 1 to 5, with a maximum score of 56. Scores below 45 are usually linked to a higher chance of falling (Blum & Korner-Bitensky, 2008)

The Scale for the Assessment and Rating of Ataxia (SARA) score was 26. SARA is eight performance-based tasks, including gait, stance, sitting, speech disturbance, and limb coordination, are observed in order to assess cerebellar ataxia using the Scale for the Assessment and Rating of Ataxia (SARA). It is frequently used in both clinical and research settings for ataxic disorders, with a total score ranging from 0 (no ataxia) to 40 (most severe ataxia) (Maas & van de Warrenburg, 2021).

6-Minute Walk Test (6MWT) was not testable. 6NWT is a practical and commonly used test to assess a person’s functional exercise capacity. It measures the distance an individual can walk on a flat, hard surface in six minutes. The test reflects the

endurance and functional status of patients with cardiopulmonary or neurological conditions (Regan et al., 2019).

Physiotherapy intervention

Physiotherapy management was provided 5 days a week for 12-week, progression was done every 1 to 2 weeks as needed according to the therapist to keep the activity challenging.

Intervention Category	Description	Frequency & Duration	Progression Strategy
Patient Education & Psychosocial Support	Comprehensive education on cerebellar ataxia pathology, prognosis, and the role of physiotherapy in functional recovery was provided. Counseling addressed emotional well-being and promoted adherence. Strategies were implemented to improve social reintegration.	1 session/week	Emphasis on patient-centered communication and motivational interviewing techniques; topics reinforced and adapted according to patient understanding and engagement level.
Seated Trunk Control Training	Exercises targeting core stability initiated on a firm surface, progressing to dynamic surface training on a therapy ball to improve postural control and proprioceptive feedback.	10 minutes/day	Progressed from static sitting to dynamic sitting with eyes closed or dual-task activities (e.g., catching ball), to challenge vestibular and cognitive systems.
Static Balance Training	Conducted on level surfaces with gradual reduction of manual support. Progressed to challenging proprioception and postural stability using unstable surfaces (e.g., foam pads, BOSU ball).	10 minutes/session	Progressed from bipedal stance to semi-tandem and tandem stances; eyes open to eyes closed; eventually introduced balance under cognitive load (dual-tasking).
Anticipatory Postural Adjustment Training	Task-specific activities requiring anticipatory postural adjustments during object manipulation, targeting trunk-limb coordination and motor planning.	Integrated into daily sessions	Gradual increase in object weight, complexity of movement tasks, and unpredictability of target location; transitioned to functional reach tasks in standing.
Reactive Balance Training	Multi-directional manual perturbations applied on a stable surface to improve postural reflexes and reactive stability.	Integrated into daily sessions	Progressed by increasing perturbation intensity, unpredictability, and adding cognitive distraction (e.g., responding to questions during training).
Frenkel's Coordination Exercises	Systematic coordination exercises for upper and lower extremities performed in various postures to improve voluntary control, spatial awareness, and timing.	Integrated throughout the program	Increased speed and precision requirements; progressed from guided to independent performance; incorporated into functional tasks.
Gait Rehabilitation	- Ambulation training on level	25 minutes/session	Progressed by reducing therapist support,

	surfaces progressed from full manual assistance to independent walking. - Tandem gait with visual cues enhanced balance and foot placement. - Backward walking used to challenge dynamic stability. - Transfer training simulated real-life scenarios.		increasing walking distance and surface complexity (e.g., uneven terrain, ramps), and incorporating direction changes and dual-task conditions.
Functional Task-Oriented Training (DL Simulation)	Simulated practice of ADLs (e.g., grooming, dressing, meal prep) to improve motor planning, coordination, and independence in daily function.	10 minutes/session	Increased task variability and complexity; encouraged performance under time constraints or environmental distractions; promoted independence with minimal cueing.

Table 1- Physiotherapy intervention

Outcome

During and post treatment

The MMSE score of 16 to 30 suggests that her cognitive functions have been fully restored where significant recovery occurred in 1st month as can be seen in table 2. Her FIM score, increased from 69 to 123, indicating functional independency and able to carry out her daily activities. Furthermore, the patient's static and dynamic balance BBS increased from 15 to 54 showing a gradual increment in balance in 3 months as can be seen in table 2. The ISS had notably improved from 32 to 119. Based on the substantial reduction in the SARA score from 26 to 9, it appears that the patient had significant recovered from ataxia. Initially patient could only walk with 2-person assistance so 6MWD was not taken, after 3 months of treatment 6MWD distance ranged from 415 meters showing significant improvement as can be seen in table 2. Additionally, the patient's functional sitting balance had improved, and she was independent in both static and dynamic sitting, as evidenced by the FIST score increasing from 18 to 56 as can be seen in table 2.

At follow up

After the treatment at follow up (after 1 month), all the test suggested of either maintenance or improvement as can be seen in table 2.

Time	MMSE	FIM	BBS	ISS	SARA	6MWD	FIST
Baseline	16	69	15	32	26	-	18
1 month	27	75	22	45	23	45	22
2 months	30	88	38	77	18	215m	32
3 months	30	123	54	119	9	415m	56
Follow up	30	125	55	115	8	440m	56

Table 2- Patient Assessment.

(MMSE- Mini-Mental State Examination; FIM- Functional Independency Measure; BBS- Berg Balance Scale; ISS- Indian Stroke Scale; 6MWD- Six Minute Walk Distance; FIST- Function in Sitting Test)

DISCUSSION

Knowing the importance of patient education and counselling, we had kept regular sessions for patient education. A recent narrative review emphasized the significant impact of psycho-social factors on neurorehabilitation outcomes. It underscores that patient education should not only address physical rehabilitation but also consider psychological support, social integration, and motivational aspects to enhance recovery. The review suggests that incorporating psycho-social education into rehabilitation programs can lead to improved adherence, reduced anxiety, and better overall outcomes in neuro rehabilitation (Shaikh & Christian, 2025).

Patient education improves self-efficacy, which is crucial for adherence to rehabilitation protocols. A randomized controlled trial by Lennon et al. (2013) demonstrated that stroke survivors who received structured education alongside physiotherapy showed significantly better self-management skills, functional mobility, and adherence to home exercise programs than those who received standard care (Lennon et al., 2013).

This case report demonstrates significant improvement in sitting balance and function as seen by the improvement of FIST score from 18 to 56. Cabanas-Valdés R et al. 2016 in their study added 15 min/day core stability exercises in addition to conventional therapy. The Trunk Impairment Scale (Spanish-Version) and Function in Sitting Test were used to measure the primary outcome of dynamic sitting balance. They found core stability exercises in addition to conventional therapy improves trunk control, dynamic sitting balance, standing balance, gait, and activities of daily living in subacute post-stroke patients (Cabanas-Valdés et al., 2016).

A recent systematic review and meta-analysis also found that Trunk exercise performed over a physio ball is effective during the acute and subacute stage post stroke (Ravichandran et al., 2020).

Training on unstable or variable surfaces—such as foam pads, wobble boards, or balance cushions—challenges proprioceptive and vestibular systems, enhancing neuromuscular coordination. All this led to improvement in patients balance as seen by BBS score from 15 to 54 in 12 weeks. Yang et al., 2023 in their study found that unstable training was effective in balance if it became unstable in standing posture. (Yang et al., 2023).

Balance training on unstable surfaces promotes proprioception, which is mediated by cutaneous receptors in the soles of the feet and mechanoreceptors within muscles and joints (Hirase et al., 2015) Therefore, performing balance training on an unstable support surface rather than performing balance training on a stable support surface can increase an individual ability to control posture by increasing external swing. Balance training on unstable surfaces improved balance ability, but previous studies involved exercises performed on unstable surfaces using tools such as a balance device or a foam rubber pad (Hirase et al., 2015) (Nam et al., 2016).

Reactive balance training addresses the ability to recover from unexpected perturbations. Our exercises include nudges, platform shifts, or functional challenges that elicit compensatory steps or trunk reactions. We also provided perturbation-based balance training to improve patients real-life balance needs, stepping response and dynamic balance. A study by Mansfield et al. (2018) evaluated a perturbation-based balance training program aimed at improving anticipatory and reactive responses. Participants in the intervention group had significant gains in BBS scores and improved stepping responses compared to the control group receiving conventional balance training (Mansfield et al., 2018).

An RCT by Handelzalts et al. (2019) investigated balance recovery training in raining in Subacute Persons with Stroke and found improvements in both reactive stepping and BBS scores, suggesting that such training enhances real-life balance resilience (Handelzalts et al., 2019).

The patient was also provided Frenkel's coordination exercises for improvement in co-ordination. After 12 weeks patients' co-ordination improved (normal). As can also be seen by SARA score which reduced to 9 from 26. A randomized controlled trial compared Frenkel's coordination exercises with PNF to conventional balance training in patients with cerebellar ataxia. They suggested that Frenkel group can effectively enhance functional reach in stroke survivors (Physiother & Ther, 2025).

Our patient also showed significant improvement in mobility as seen by improvement if 6 MWD from 0 meter to 415-meter, Task-specific training (e.g., sit-to-stand, bed-to-chair transfer, stair stepping) replicates real-life activities, improving both lower limb strength and movement planning. These tasks contribute to endurance and functional walking capacity.

Qurat-Ul-Ain 2018 et al. in their RCT compared Traditional therapy with task specific circuit training on Gait parameters. Eight work stations of different activities related to balance and gait were defined at each work stations. These activities included tandem walk, one leg standing, one leg standing on foam, walking on different surfaces, stair climbing, standing on balance board, walking on a set pattern on floor and moving through obstacles. They found significant improvement was recorded in TUG

(p=0.014). Cadence (p=0.001), step length (p<0.001) (Qurat-ul-Ain et al., 2018)

Tandem walking (heel-to-toe) and reverse walking (backward walking) require enhanced trunk control, anticipatory postural adjustments, and cognitive attention—all of which contribute to improved gait symmetry and control.

In a study by Kalidasan et al., 2019 showed that after four weeks of backward gait training period, subjects in the experimental group showed much improvement than those in control group for gait performance, walking speed (score: 14.4±2.11 versus 20±0.5) (p<0.05), and cadence (score: 114.6±3.76 versus 97.06±1.61) (p<0.05) (Kalidasan et al., 2019).

In 12 weeks, patient demonstrated significant improvement in independency as can be seen by improvement in FIM from 69 to 123 and improvement in ISS from 32 to 119. The effectiveness of TOT lies in its ability to drive activity-dependent plasticity. Repetitive practice of goal-oriented tasks stimulates motor cortical areas, promoting re-mapping of movement patterns and recovery of function (Langhorne et al., 2009).

We also assessed the patient after 1 month for follow-up and we found that almost all the parameters were either same or had improved suggesting the efficacy of management and transfer of skill at home environment.

CONCLUSION

This case report demonstrates that tailored made individual specific exercise protocol with regular counselling can lead to improvement in a Post non-haemorrhagic acute stroke with hydrocephalus. Also, this case demonstrates the need of keeping the counselling sessions, exercise challenging and regular increment in complexity of training for better improvement. The case study also shows a very good carry over effect after 1 month of cessation of exercise at follow up.

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