Rehabilitation of Motor Coordination Deficits and Fear of Falling in an Acute Cerebellar Stroke: A Case Report

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ABSTRACT:
An acute cerebellar stroke is a sudden loss of blood supply to the cerebellum, the part of the brain responsible for coordination, balance, and fine motor control. It results from either an ischemic event (blockage of a blood vessel) or, less commonly, a hemorrhage (bleeding) within the cerebellum. This leads to sudden onset of symptoms such as dizziness, unsteady gait (ataxia), poor coordination, nausea, and balance difficulties. Cerebellar stroke often causes problems with motor coordination, leading to balance issues and difficulty controlling movements. These coordination deficits increase the risk of falling and can create a strong fear of falling, which makes patients avoid daily activities and lose confidence. This case report describes a patient with an acute cerebellar stroke who had poor limb coordination and severe balance problems. Because of this, the patient developed a fear of falling that limited mobility and daily tasks. A focused physiotherapy program with balance training and coordination exercises helped improve motor control and reduced the patient's fear of falling.

Keywords: Cerebellar stroke, Motor coordination, Fear of fall, Balance training, rehabilitation.

INTRODUCTION

Stroke remains one of the leading causes of long-term disability worldwide, with cerebellar stroke accounting for approximately 2–3% of all ischemic strokes.(1) Although less common than supratentorial strokes, cerebellar strokes carry significant morbidity due to their profound impact on motor coordination, balance, and postural control. The cerebellum plays a pivotal role in integrating sensory inputs and coordinating fine and gross motor activities, and its impairment results in a distinct set of motor coordination deficits such as ataxia, dysmetria, and impaired postural stability. (2) One important problem seen in patients with cerebellar stroke is fear of falling (FoF). This is a constant fear of losing balance and falling, which causes people to avoid daily activities and reduce their physical activity. (3) This fear can develop due to the motor coordination deficits such as ataxia (unsteady movement), poor muscle control, and balance problems following the stroke. Recent studies have shown that fear of falling not only affects physical recovery but also has a psychological impact, reducing confidence and quality of life. (4)

Fear of falling refers to a lasting concern about falling that can lead to avoidance of activities, loss of confidence, and further physical deconditioning. Cerebellar strokes are relatively rare, making up about 2–3% of all ischemic strokes and around 9–10% of strokes affecting the posterior circulation of the brain.

Most cases are seen in people between 60 and 75 years of age, and they are slightly more common in men. (1) Imaging techniques like MRI and CT scans, cerebellar strokes are now detected more accurately than before. Even though less frequent than other types of strokes, cerebellar strokes have a strong impact on a person's ability to move safely, increasing the chances of falling and causing long-term disability if not properly managed. (5)

In this case, the patient presented with marked coordination difficulties and severe postural instability, which led to a strong fear of falling and reduced participation in daily life. Physiotherapy plays a key role in addressing these challenges by using targeted exercises to improve balance, limb coordination, and gait while also helping to build the patient's confidence in movement. A well-structured physiotherapy program not only improves physical function but also reduces fear of falling, supports safe mobility, and restores greater independence in activities of daily living.

Case presentation :

A 70-year-old male patient presented with weakness in the right upper limb and lower limb for past 3 months. He described a persistent heaviness in the right shoulder, accompanied by noticeable difficulty in performing day-to-day tasks. The patient specifically mentioned difficulty while performing gripping activities, such as holding farming tools and household items, and experienced problems with overhead activities like reaching for objects placed on higher shelves.These functional limitations had gradually led to a noticeable reduction in his physical activity levels and a growing fear of falling, affecting his confidence and social participation. The patient exhibited right-sided dysmetria and limb ataxia, along with intention tremor and impaired fine motor coordination,

The patient has no known history of hypertension (HTN) or diabetes mellitus (DM). There is no relevant surgical history. On personal history, the patient reported being a chronic smoker for the past 10 years. There is no significant family history of neurological or cerebrovascular disorders. The patient follows a mixed diet as part of his regular nutritional intake. There was no history of trauma.

Fig;1 Coordination test (finger to nose test)

Fig;2 Tandem walking

Clinical findings:

DIAGNOSTIC TEST	FINDINGS
MRI - Acute Infarcts	Diffusion restriction/ADC reversal in: • Left medial temporal lobe • Left lateral thalamocapsular region • Left occipitoparietal cortical/subcortical areas
MRI - Lacunar Infarcts	Noted in: • Right gangliocapsular region • Left putamen • Bilateral corona radiata • Fronto-parietal regions
MRI - Right Cerebellar Hemisphere	• Perilesional oedema suggestive of recent infarct • Cerebral and cerebellar shrinkage noted • No significant midline shift • No obstructive hydrocephalus
Impression	Multi-territory acute infarcts including the right cerebellar hemisphere with evidence of chronic small vessel ischemic changes
Diagnosis	Acute cerebellar stroke (right hemiparesis)

On balance examination using the Berg Balance Scale, which is a standard tool to evaluate balance and the risk of falling. The total score obtained was 32 out of 56, which indicates a moderate risk of falls. A fall efficacy scale- international (FES-1) total score of 42/64 indicates high concern severe fear of falling likely avoiding many activities.

The Romberg test was positive, with slight swaying to the right side and increased sway length 5cm when the eyes were closed. The patient had a Barthel Index score of 60, indicating moderate dependency in activities of daily living (ADL).

Non equilibrium test scores were 4 on the right side and 5 on the left, indicating slightly reduced coordination on the right upper and lower limbs. Mild dysmetria and incoordination on the right side.
Equilibrium tests indicate that the patient has mild to moderate impairment in dynamic balance and coordination, especially in complex movements. Tandem walking and multidirectional walking tasks indicate increased risk of imbalance or fall, particularly during advanced mobility tasks.

Outcomes:

Pre and Post Treatment Outcome Measures Table:

Outcome Measure	Pre- Treatment	Post-Treatment	Interpretation
Non equilibrium tests Equilibrium tests	28/40 - reduced coordination 27/40- reduced coordination	35/40- improved coordination 34/40-improved coordination	Indicates improvement in coordination, particularly in balance and postural control."
Berg Balance Scale(BBS)	32/56-moderate fall risk	48/56-mild fall risk	Improved balance and reduced fall risk
Romberg's test	Unable to maintain balance in Romberg stance (eyes closed) for more than 5 seconds	Able to maintain balance for 20–30 seconds with minimal sway	Improved lower limb coordination,
Falls efficacy scale	42/64-Indicates a high concern about falling	28/64-Indicates a reduced fear of falling	Improved confidence in performing daily activities and better perceived balance safety
Barthel index	55/100-moderate dependency in activities of daily living (ADL).	80/100-more independent in managing self-care tasks and mobility	Indicating significant functional recovery and improved independence in daily activities.

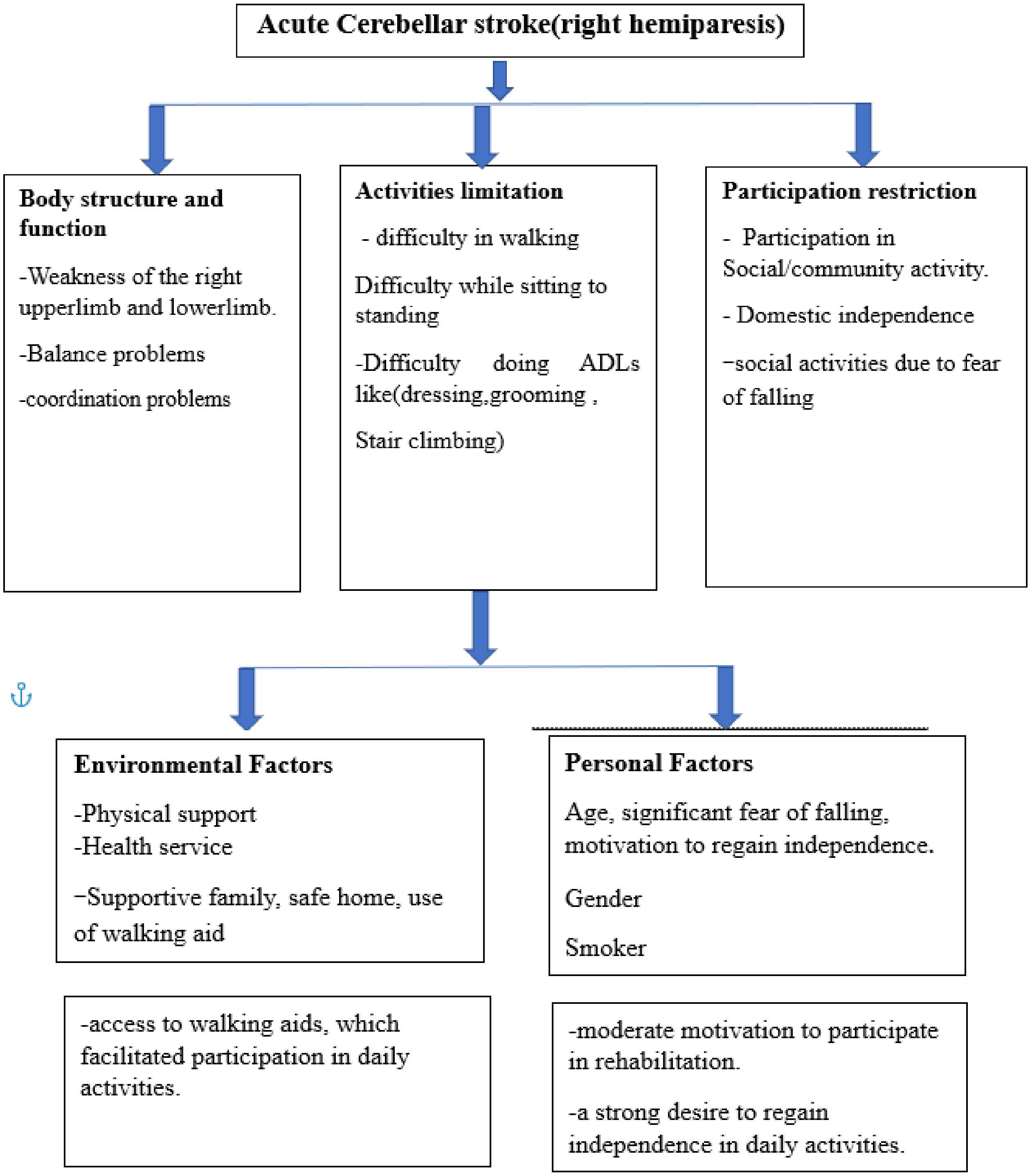
TREATMENT INTERVENTION:

The patient was treated with a comprehensive physiotherapy program focused on improving joint mobility, muscle strength, coordination, balance, and functional independence.
The International Classification of Functioning, Disability and Health (ICF) model developed by the World Health Organization provides a holistic approach to understanding the impact of a health condition on an individual's functioning. In this case, the ICF model was used to structure the rehabilitation strategy for a patient with acute cerebellar stroke. The components of body functions and structures, activities, participation, environmental factors, and personal factors were all considered to develop a targeted

rehabilitation program that addressed balance ,coordination and functional limitations. The following table summarizes the patient's impairments and corresponding interventions within the ICF framework.(10)

Treatment protocol:
Gripping and Fine Motor Training:
Frequency:5 days/week
Intensity: Moderate effort(resistance bands/therapy putty graded to tolerance)
Time:30–45 minutes per session.
Type : Gripping acivities for :-
Finger flexor/extensor strengthening (bands, therapy putty)
• Wrist curls/extensions (1 kg)
• Writing
• Buttoning shirts
• Cutting with scissors
• Rubber band stretches/squeezes
Balance Training:
Frequency:5–6 days/week
Intensity: Mild to moderate challenge (depending on surface stability and visual input)
Time:20–30 minutes per session.
Type : Balance training:
Single-leg stance (eyes open → closed)
• Alternate foot on stool
• Standing with eyes closed
• Static balance on stable/unstable surfaces
Coordination Exercises (Frenkel's):
Frequency: Daily (6–7 days/week)
Intensity: Low to moderate (gradually increasing complexity with control)
Time:20–30 minutes per session.
Type : coordination exercises :
Walking on visual footprints
• Sideways walking
• Tandem walking (heel-to-toe)
• Heel and toe walking
Muscle Strengthening Exercises:
Frequency:3–4 days/week (alternate days to allow recovery)
Intensity: Moderate, progressively increased
Time: 30–40 minutes per session.
Type : Progressive resisted exercises (manual → TheraBand/weights)
Focused on shoulder, elbow, wrist, hip, knee, ankle
Activities of Daily Living (ADL) Training:
Frequency (F): 5 sessions per week
Intensity (I): Low to moderate intensity, progressing from assisted to independent practice
Time (T): 20–30 minutes per session

Type (T) : ask-oriented training focused on:
Dressing and undressing
Grooming (washing face, brushing teeth)
Bathing practice (safe transfers in/out of bathing area)
Feeding tasks (holding utensils, self-feeding)
Bed mobility and sit-to-stand transfers.



After four weeks of treatment, the patient showed noticeable improvement in right-sided limb coordination and grip strength. His ability to perform fine motor tasks, such as writing and gripping objects, improved significantly. There was also a marked reduction in his fear of falling, which led to better participation and confidence during therapy sessions. Functionally, the patient became capable of walking short distances with support and was able to climb stairs with assistance. Additionally, he regained greater independence in performing basic activities of daily living (ADLs). The improvement was also reflected in a better score on the Falls Efficacy Scale–International (FES-I), indicating reduced fear and improved mobility confidence.

Discussion:

A 70-year-old male with right cerebellar stroke was assessed in OPD of college of physiotherapy, SVIMS, Tirupati. A stroke in the cerebellum affects both movement and mental confidence. The cerebellum controls coordination, balance, and posture. When it's damaged, patients often experience unsteady movements (ataxia), poor hand control, and difficulty keeping balance. (7)

The patient had trouble with tasks like gripping, writing, and walking up stairs. Tests showed that his coordination was worse on the right side, which matched the MRI findings of a right-sided cerebellar stroke. He also had a high Falls Efficacy Scale (FES-I) score, showing that he had a strong fear of falling. This fear made him less active, slowing his recovery.(4)

To help with this, a complete physiotherapy program was given. It included Frenkel's exercises (to improve coordination), balance training, strength **exercises** and structured Activities of Daily Living (ADL) training(7). The ADL training focused on helping him safely perform everyday tasks such as dressing, grooming, toileting, bathing, and feeding. Repeated practice of these tasks, along with the use of safe techniques and adaptive methods when needed, gradually improved his independence in daily life. These helped him walk better, stand more steadily, and regain better control of his hand. Most importantly, his confidence improved, and he was more willing to move and take part in therapy.(9)

This case shows that treating stroke patients isn't just about improving movement but also about rebuilding their confidence to safely engage in everyday activities. It's also important to help them feel safe and confident again. Addressing the fear of falling is a key part of successful recovery. In short, a combination of physical therapy, structured ADL training and emotional support helped this patient recover better after his cerebellar stroke.(3)

Conclusion:

A targeted physiotherapy rehabilitation protocol focusing on balance, coordination, and muscle strengthening showed significant improvements in coordination and functional performance in this patient with right hemiparesis. Regular practice of Frenkel's exercises, balance drills and structured ADL training were especially beneficial in regaining postural control, mobility, and independence in daily self-care tasks. There is a significant relationship between incoordination and fear of falling; patients with greater severity of incoordination tend to exhibit a higher fear of falls. Therefore, enhancing motor coordination can help reduce this fear by increasing confidence in movement.

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