Case Study

A Case Report - Physiotherapy Rehabilitation in a Chronic Ataxic Stroke Patient

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Abstract

Introduction: The cerebellum is primarily responsible for coordination, balance, and muscle control. Cerebellar infarction or haemorrhage can lead to an acute onset of cerebellar dysfunction. The dysfunction often leads to ataxia, which is defined as impaired coordination of voluntary muscle movements.

Case Presentation: A 54-year-old male rickshaw driver presented with difficulties in walking and transferring, as well as multiple episodes of falling. He also experienced challenges with activities of daily living, such as bathing, dressing, and eating, following a cerebrovascular accident around 7 years ago.

Intervention: Intervention was given 1.5 hours per day,5 days a week, for 8 weeks. Intervention includes education sessions, static and dynamic balance training, quasi-mobile task, body weight support treadmill training, stair gait training, slope walking, transfer activity, and task-specific training.

Outcomes: After the 8 weeks of intervention, the FIM score improved from 83 to 105, the BBS score improved from 26 to 36, and the ISS score increased from 74 to 83. The time taken to complete the 5 Times Sit to Stand Test decreased from 1.26 minutes to 40 seconds, and the number of falls reduced from 3 to 0. Retention of the exercise effect was also seen in follow-ups (1-2 months).

Conclusion: A tailor-made, goal-oriented physical therapy intervention including education, counselling sessions, and exercises designed and implemented based on the principles of motor control, motor learning, and neuroplasticity will provide recovery even in chronic ataxic stroke patients.

Key words: Chronic stroke, cerebellar ataxia, rehabilitation, balance, gait.

Introduction

The cerebellum is primarily responsible for coordination, balance, and muscle control. Cerebellar infarction or hemorrhage often leads to ataxia, which is defined as impaired coordination of voluntary muscle movements.[(1)]

Cerebellar infarcts account for only about 2% of all strokes.[(2)] Ataxia is a notable consequence and

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may present with symptoms including dysmetria, dysarthria, hypotonia, the rebound phenomenon, and nystagmus. Gait ataxia is specifically characterized by patterns such as stumbling, irregular foot placement, large steps, a wide base of support, and abnormal joint torque.[3]

Cerebellar stroke leads to increased postural sway and poorly coordinated postural responses during volitional movements. Gait variability is a common characteristic, resulting from a combination of balance impairments, inter-limb incoordination, and a lack of coordination between postural activity and leg movement. These intrinsic balance problems contribute to a high incidence of injurious falls.[4]

Ataxic hemiparesis and related syndromes present distinct rehabilitation needs—such as balance, coordination, and gait training—that are not fully addressed by standard stroke protocols. Rehabilitation protocols for chronic ataxic stroke are underrepresented in the literature. Most studies focus on general stroke or ataxia from other causes, leaving a gap in practical, detailed guidance for clinicians treating chronic ataxic stroke.By documenting novel or tailored interventions, case reports can highlight effective approaches, inform future clinical trials, and contribute to the development of standardized protocols. [5][6][7]

Case reports provide in-depth accounts of individualized rehabilitation strategies, including the rationale, progression, and outcomes of specific protocols. This helps clinicians understand how to apply principles like motor learning and neural plasticity in real-world settings. [7]

The purpose of this case report is to provide an effective and comprehensive assessment and management strategy for individuals with chronic cerebellar stroke.

Patient Information

Case Description

A 54-year-old male patient from Samarkha, Anand, came to us with complaints of difficulty walking and transferring, along with multiple episodes of falling. He also experiences challenges in performing daily living activities such as bathing, dressing, and eating following a cerebrovascular accident in 2017 (over 7 years ago).

History

In July 2017, while driving a rickshaw in the morning, he suddenly felt tingling all over his body and had difficulty steering. He was taken to a local physician, who referred him to a multispecialty hospital. He was admitted for one and a half days, during which necessary investigations were conducted. Following this, he was transferred to a tertiary care hospital, where he spent 10 days in the ICU and another 10 days inthe general ward. He was unconscious for the first four days of his stay. There, he received appropriate medical and physiotherapy care.

After being discharged, he began physiotherapy management and achieved independent standing for one minute in three years. He managed to walk a few steps with a walkerfive years after the incident. Due to financial constraints, he had irregular physiotherapy sessions. Now that the patient has received monetary aid, he would like to continue physiotherapy at our department.

Diagnostic Imaging

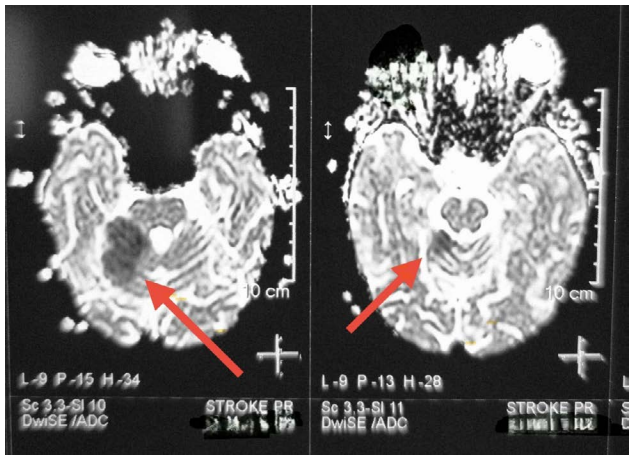

Figure: -1 MRI of the patient

The figure shows a left cerebellar ischemic lesion.

Clinical Findings

Patient consent was obtained before conducting the study. The patient was informed about all procedures and was made aware that participation was voluntary; he could withdraw from the study at any time.

The patient demonstrated normal cognition and metacognition, with stable vital signs. He has had a history of hypertension for 8 to 9 years, which is currently well-managed with medication. There were no other comorbidities noted. His general appearance was good, with a BMI of 27.3 kg/m^2. He was enthusiastic, but his speech lacked affection, and there was mild slownesspresent.Effective two-way Communication was intact. All cranial nerves were functioning properly, and there were no sensory or perceptual impairments. Upon observation, the patient exhibited a flexed posture and required assistance from one person, along with the use of a walker for locomotion. Examination revealed increased muscle tone in all four limbs. Reflexes were exaggerated (grade 3+), except for the calf muscle, which was graded at 1+ bilaterally. Range of motion (ROM) for all joints was within functional limits. The upper limbs appear minimally affected, allowing the patient to perform all self-care activities independently, though he was having mild difficulty opening his hands. Thus, he was functionally independent. As it was not the concern of the patient, the primary focus of management was on improving balance and gait.

The assessments included the Berg Balance Scale (BBS), the Timed Up and Go (TUG) test, the 5 Time Sit to Stand test, the 10-meter walk test (both with and without a walker), the 6-minute walking distance test, the Functional Independence Measure (FIM), and the Indian Stroke Scale (ISS).

The Berg Balance Scale was used to evaluate both static and dynamic balance through fourteen components, yielding a total score of 26 out of 56. The BBS assesses various tasks such as standing up from a sitting position, balancing on one foot, and reaching forward while standing.[8]

The Functional Independence Measure (FIM) is a seven-level ordinal scale comprising 18 items across six domains: self-care, sphincter control, mobility, locomotion, communication, and social cognition. It is commonly used to assess a patient's functional independence and level of disability.[9] The total FIM score for this patient was 83.

The Indian Stroke Scale (ISS) measures the limitations in daily activities experienced by stroke patients in India. The total ISS score for this patient was 74 out of 105.

The Indian Stroke Scale (ISS) is a culturally tailored, patient-reported outcome measure designed to assess functional participation in daily activities among stroke survivors in India. Developed by Dr. Prakash V. and colleagues, the ISS consists of 25 items that cover various domains such as mobility, self-care, domestic life, and social participation, reflecting the unique socio-cultural context of Indian patients.[10]

The Trunk Impairment Scale (TIS) evaluates static and dynamic sitting balance as well as trunk coordination while seated.It evaluates three main components: static sitting balance, dynamic sitting balance, and trunk coordination. Each item on the TIS is scored on an ordinal scale, with total scores ranging from 0 to 23, where higher scores indicate better trunk function.[11] The patient's total score was 11 out of 23.

The patient took 1 minute and 26 seconds to complete the Five Times Sit to Stand Test, a useful assessment tool for evaluating the ability to transition between sitting and standing. Performance on this test depends on lower-limb strength and balance control.[12]

The patient covered a distance of 40 meters using a walker during the Six-Minute Walk Test. This test is a widely recognized assessment tool in stroke rehabilitation, measuring functional mobility, endurance, and cardiovascular fitness. It is sensitive to changes in functional status, making it valuable for monitoring rehabilitation progress and evaluating the effectiveness of interventions.[13]

The 10-Meter Walk Test measures the time required to walk a defined distance, assessing walking speed in meters per second. For this patient, the time taken

was 1 minute and 6 seconds with a walker and 3 minutes and 8 seconds without a walker. The 10-Meter Walk Test is widely used to evaluate walking speed and functional mobility in stroke patients, providing insights into gait performance and endurance.[14]

Additionally, we asked the patient about the number of falls he experienced in the past month, and they reported three falls.

Therapeutic Intervention

Physiotherapy management was provided for 1.5 hours per day. Three to four minutes of rest were given as and when needed by the patient, 5 days a week, for 8 weeks. Progressions were made every one to two weeks as necessary, according to the therapist's judgment, to keep the activities challenging. The physiotherapy sessions were conducted by an experienced neuro-physiotherapist.

After two months, the patient was advised to continue exercising at homeand with progression at their own pace, as the patient could not continue sessions due to socioeconomic reasons,and was assessed again after one and two months.

Table No. 1. Physiotherapy Management

(BWSTT- Body weight support treadmill training)

Goal	Intervention	Description	Progression	Dosage
Education/ counseling	One-to-one interaction with a neuro-physiotherapist	The therapist provided education about the condition, recovery, and prognosis. The patient was encouraged to ask any questions he had during the counseling session, and they were comprehensively answered by the therapist.	-	5 - 20 min once every 2 weeks
Static balance	Standing	Standing on a variable surface With open and closed eyes. With a different base of support	By reducing the base of support and closing the eye	10 mins
Dynamic balance	Quasi mobile task – reach out in sitting and standing with Head movement, Upper limb movement, trunk movements	Functional movement relevant to the patient was performed, like reaching out for a bottle, or jar, or clothes in a standing position And in sitting, shifting a bottle or a 1-2 kg bag, and manipulating heavier objects weighing 3 to 5 kg.	Increasing the distance to reach, and increasing the weight of the object	20 mins
	Reactive balance control	Perturbation in standing with and without eyesclosed.	Increasing intensity and force of perturbation	5 mins
	Transfer training	Sit to stand from a variable surface of variable heights.	By reducing the height	5 mins

Continue....

Gait training	BWSTT	BWSTT with lifting 20 % body weight	Increasing speed on the Treadmill	10 mins on alternate sessions for 1 month
	Stair gait training	With railing assistance and minimal assistance or supervision	Increasing number of stairs	5 mins
	Slope walking	Reverse slope walking with railing assistance under supervision	Reducing the assistance of the railing and increasing speed	10 min
Indoor Walking	Transfer activity	With the use of crutches and minimal assistance, the patient was prompted to get up, walk, and then sit down in a simulated environment similar to his home.	Reducing assistance and increasing speed	10 mins on alternate days
Improve upper extremity functions	Task-specific Training	For Bathing, eating, dressing, wearing, and removing clothes	Increasing complexity of the task as per task performance and analysis	20 mins

Outcomes and Follow-Up

Table No. 2. Here, all the assessments of the patient were given from baseline to follow-up month, including monthly assessment data

(BBS-Berg balance scale, ISS-Indian stroke scale, 6MWT-6-Minute walk test, FIM-Functional Independence Measures, TIS-Trunk Impairment Scale, 5TSTS-5-TimeSit-to-Stand,
10MWT- 10-Meter walk test)

Time	BBS	ISS	6MWT with walker (Meter)	FIM	TIS	5TSTS (min)	10 MWT (Min)	10 MWT (min)	NUMBER OF FALLS
Baseline	26	74	40	83	11	1.26	1.06	3.08	3
1 month	31	81	50	104	13	0.49	1.05	2.27	0
2 months	36	83	63	105	13	0.40	0.50	2.40	0
3 months (follow-up 1)	36	80	55	105	13	0.45	0.59	3	0
4 months (follow-up 2)	36	80	65	105	13	0.40	0.55	2.50	0

At 1 and 2 months (During and post-rehabilitation)

In comparison with the baseline data, there was a significant improvement in balance. The Berg Balance Scale (BBS) score increased from 26 at baseline to 36 out of 56 after 2 months. Additionally, the Indian Stroke Scale (ISS) score rose from 74 to 83. There was an improvement in 6MWT distance, increasing from 40 meters to 63 meters; however, this improvement was not statistically significant, as the Minimal Clinically Important Difference (MCID) for 6MWT is 44 meters. [14]

The Functional Independence Measure (FIM) also showed significant improvement, increasing from 83 to 105 after 2 months, exceeding the MCID value for stroke, which is 22.[15]

Trunk function demonstrated a slight increase; the Trunk Impairment Scale (TIS) score went from 11 to 13, but this change was clinically insignificant.[16]

The performance on the 5-time sit-to-stand test improved drastically, reducing from 1.26 minutes to only 40 seconds after 2 months.

In the 10-meter walk test, the baseline times were 1.6 minutes with a walker and 3.8 minutes without a walker. After 2 months, these improved to 0.50 minutes with a walker and 2.40 minutes without.

Lastly, the number of falls significantly decreased, going from 3 times at baseline to 0 times after 2 months of treatment.

At 3 and 4 months (Follow-up)

By the third month, the patient was not exercising regularly, leading to a decline in his condition and some unchanged parameters. The Berg Balance Scale (BBS) score remained the same as the previous month at 36/56. However, the Indian Stroke Scale(ISS) score decreased from 83 to 80, and the distance for 6MWT also reduced from 63 meters to 55 meters. The Functional Independence Measure (FIM) score remained unchanged at 105-126, indicating no progress. There was no improvement in the Trunk Impairment Scale (TIS), which stayed at 13. The time for the Five Times Sit-to-Stand (5TSTS) test increased by 0.5 minutes, and the time for the 10-meter walk test also increased. The number of falls remained unchanged at 0, consistent with the previous month.

Recognizing the importance of consistent treatment, we provided education to the patient and encouraged him to do regular exercise. By the fourth follow-up month, all parameters were closer to those recorded in the second month.

Discussion

This case report demonstrates that two months of intensive, goal-oriented functional rehabilitation significantly improves the patient's condition.

Research has highlighted the importance of education and counseling as key components in neurorehabilitation management.[17] Education was provided to the patient and caregiversregarding the importance of healthcare management, lifestyle behavior changes, and self-monitoring

The case also demonstrates a significant improvement in balance, as measured by the Berg Balance Scale (BBS) and the Trunk Impairment Scale (TIS), following balance training.A systematic review indicates that exercise therapy, including balance training, leads to gains in balance capacity.Such interventions can foster meaningful neurological adaptations. Engaging in repetitive balance tasks promotes neuroplastic changes in the brain, facilitating motor relearning and improved coordination. [18]

Perturbation-based balance training (PBT) has been shown to enhance balance by improving reactive balance control and reducing the risk of falls. Itdecreases the number of compensatory steps taken in response to perturbations, indicating improved stability and balance control.[19]

Our balance training also included Task-specific training that closely mimics real-life balance challenges, which enhances the transfer of training effects to daily activities, ultimately improving overall functional mobility.[20] Task-oriented training (TOT) incorporates timed mobility and dynamic balance

activities based on daily life demands,significantly improving balance. This approach promotes neuroplasticity, enhances motor control, and facilitates functional task performance. [21][22]

Our patient showed substantial improvement in gait and dynamic balance through gait training with BWSTT, stair gait training, slope training, and task-oriented transfer training. This method enhances gait parameters by improving walking speed, endurance, and balance.[23]

Overground gait training enhances coordination and control, leading to improved ambulation. It significantly increases walking speed, endurance, and functional mobility.[23]

Walking backward requires greater postural control and proprioceptive feedback, which can enhance balance, stability, and overall gait performance. It significantly improves gait speed, stride length, cadence, and balance in chronic stroke patients due to the increased demand for postural control and coordination during this activity.[24]

We also provided stair gait training, as itreduces fall incidents and improvesthe ability to perform independent activities. It enhances walking ability and shows positive results in the swing phase of walking.[25]

The patient received 20 minutes of Task-Oriented Training (TOT) for bathing, eating, and dressing. TOT has been shown to improve functional outcomes in chronic stroke patients by enhancing neuroplasticity, motor control, and daily activity performance, ultimately promoting greater independence.[26]

Improvements were observed at both the 1-month and 2-month follow-ups. But at 1st follow-up,some amount of reduction in a few outcome measures was seen, so educationwas provided to improve adherence to exercise. By the 2nd follow-up, the patient demonstrated significant recovery and maintained functional status. A recent review has alsosuggested that integrating psychosocial education into rehabilitation programs can enhance adherence and overall results.[27]

Conclusion

This case report highlights that intensive, goal-oriented functional rehabilitation over two months can lead to significant improvements in patient outcomes, particularly in balance, gait, and functional mobility. The targeted use of balance training, task-oriented therapy, and gait-related interventions facilitated meaningful neuroplastic changes and enhanced motor relearning, resulting in improved independence in daily life activities. Incorporating education, counselling, and psychosocial interventions proved essential for fostering adherence and sustaining gains throughout the rehabilitation process. These findings underscore the importance of tailor-made, goal-oriented neurorehabilitation strategies in promoting recovery for chronic stroke patients.

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Conflicts of Interest Statement

We declare that there are no conflicts of interest related to this article / study. All findings, conclusions, and recommendations are made objectively and impartially.

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