CASE REPORT

THE EFFECT OF PHYSICAL THERAPY INTERVENTION AFTER CEREBELLAR RESECTION

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A variety of diseases, including gait ataxia, lack of coordination, diminished dexterity, and unsteady posture, can be brought on by cerebellar dysfunction. This case study looks into how a physical therapy program affected a 40-year-old patient's dynamic balance after cerebellar tumour surgery. The patient complained of losing his balance and having uncoordinated motions on the left side of the body. The Timed Up and Go (TUG) test was used to gauge how the Frenkel coordination exercises and balance training affected dynamic balance following cerebellar tumour removal. The patient's muscle strength in the left-side hip extensors, abductors and adductors, knee flexors and extensors, as well as the left-side shoulder, elbow, and wrist flexion and extension, significantly improved.

Keywords: Cerebellar dysfunction; Hemangioblastoma; Physiotherapy; Gait disturbances

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INTRODUCTION

The cerebellum is an essential component of the human brain that is crucial for controlling movement, coordination, and balance.[1] A wide range of signs and symptoms, including dysdiadochokinesia (inability to make alternate motions rapidly), ataxic gait, nystagmus of the eyes, dysarthria, purposeful tremor, and hypotonia, can be caused by injury and subsequent damage to the cerebellum.[2] The cerebellum is where hemangioblastoma (HB), a vascular tumour, most usually develops. Single HB may be uncommon, but von Hippel-Lindau (VHL) illness is occasionally linked with several tumours. VHL affects both men and women equally, with an incidence of 1 in 30000 to 1 in 50000.[3,4]

Cerebellar HBs may be accompanied by headaches, nausea, abnormal gait patterns, or ataxia.[5] Following cerebellar resection, physiotherapy aims to help the injured person move and function normally.[6] The Timed Up and Go (TUG)[7,8] test was used in this case report to examine the impact of the physical therapy program on dynamic balance following cerebellar tumour excision and to give a complete examination of HB of the cerebellum.

CASE PRESENTATION

After having a cerebellar tumour removed, a 40-year-old male patient was referred for outpatient physical therapy with the main complaint of losing his balance and having uncoordinated motions on his left side of the body. A thorough medical history revealed that the patient had undergone left nephrectomy, ventriculoperitoneal shunt insertion, right cerebellar hemangioblastoma resection (in 2006), laser surgery in both eyes, VHL syndrome, pulmonary embolism, retinal hemangioblastoma, hypertension, diabetes mellitus (DM), and hypercholesterolemia. The patient was using an anticoagulant called warfarin, as well as an antihypertensive drug and insulin injection for diabetes. The patient also underwent chemotherapy for five months following cerebellar tumour removal surgery in 2019.

The patient required assistance for moving about the house and getting to work because of physical impairments that prevented him from doing personal hygiene tasks, standing, and walking, at the time of his admission. Physical therapy treatments for the patient had to be discontinued for two months while the country was under lockdown due to the COVID-19 pandemic in 2020, which caused his condition to worsen.

The patient was discovered to speak in staccato, have a laterally deviated right pupil, and be wearing a hearing aid in his right ear during the initial assessment. The patient was attentive, obedient, and followed instructions well. His level of orientation was X3. The Modified Ashworth Scale (MAS) was used to measure muscle tone in the elbow and hip flexors and extensors, and the results showed that the patient's muscle tone was normal. An evaluation of the superficial (planter) and deep (ankle, knee, and triceps) tendon reflexes revealed normal responses. The patient's senses appeared to be unaffected by the evaluation of the superficial sensation (pain, warmth, and pressure), deep sensation (proprioceptive and kinesthesia), and integrated cortical sensation

(graphesthesia and barognosis). With assistance from the therapist, the patient moved five meters back and forth without using a cane. He had a cautious walking pattern with an off-kilter rhythm, short strides with a loss of right foot heel striking, and left foot outward rotation. Manual muscle testing (MMT) and a non-equilibrium coordination test, respectively, were used to evaluate the motor strength and coordination of the upper and lower limbs (Tables 1 and 2). The patient was asked to turn his head to both sides while turning his trunk and picking up an object off the floor to test his dynamic sitting balance. The patient was asked to sit on the edge of the bed while holding the rails with both hands to test their static sitting balance. The patient was asked to stand for 10 seconds each with their eyes open and closed to test their static standing balance. By requesting the patient to stand and then turn his head to both sides, dynamic standing balance was evaluated. (Table 2). The following movements were rated according to scales and definitions from the Functional Independence Measure (FIM): rolling (Grade 7-fully independent), lying to sitting (Grade 6-modified independent), sitting (Grade 6-modified independent), sitting to standing (Grade 5-need supervision), standing to sitting (Grade 4-minimal assistance), and standing (Grade 5-need supervision).

As part of the patient's at-home exercise regimen, therapeutic exercises like Frenkel coordination drills and balance training were offered (Table 3). From a supine position, lower limb (sidekick) coordination exercises were carried out. The remaining upper-limb coordination activities, however, were carried out while seated. After the session, all other balance-training exercises were completed. The TUG test was done by asking the patient to stand from a back-supported chair with armrests to walk up to a 3-meter distance, then turn 180° and return to sit on the chair. If the time taken to perform this test exceeds 13.5 seconds, it indicates that the patient has a high risk of falling, and/or mobility and balance impairment (Table 3).[7–9] Following the six-week intervention period, the patient demonstrated a significant improvement in muscle power in the left-side hip extensors, abductors and adductors, knee flexors and extensors, shoulder flexion and extension, elbow flexion and extension, wrist flexion and extension. However, left shoulder abductors and ankle dorsiflexors both showed a decrease in strength. The therapist's treatment, which emphasized strengthening the shoulder flexors and extensors, may have contributed to this. Following routine physical therapy, MMT reevaluated the patient's gait and found considerable improvement (Table 1). According to the FIM re-evaluation, the patient could complete each task on his or her own (grade 7). Following therapy, balance and coordination also significantly improved, with the left upper and lower limbs' coordination going from bad to fair (Table 2).

Table-1: Assessment of manual muscle test (MMT) before and after the commencement of the physical therapy

	Before the commencement of physical therapy		After the commencement of the physical therapy	
Upper Limb	Right	Left	Right	Left
Shoulder flexion	-4	-4	4	+4
Shoulder extension	5	5	4	4
Shoulder abduction to 90	-4	+3	-4	+3
Elbow flexion	-4	-4	5	5
Elbow extension	+4	+4	5	5
Wrist flexion	+4	+4	5	5
Wrist extension	+4	+4	5	5
Lower Limb	Right	Left	Right	Left
Hip flexion	5	5	5	5
Hip extension	-4	+3	-4	-4
Hip abduction	-4	3	5	5
Hip adduction	-4	3	-4	-4
Knee flexion	4	4	5	5
Knee extension	-4	-4	5	5
Ankle dorsiflexion	-4	-4	5	+3

Table-2: Comparison of coordination and balance before and after physical therapy

Coordination	**Before physical therapy**		**After physical therapy**	
Upper Limb	**Right**	**Left**	**Right**	**Left**
Finger to finger	Good	Poor, Decomposition of movement	Good	Fair (the movement was with moderate speed)
Finger to nose	Good	Poor, Decomposition of movement	Good	Fair (the movement was with moderate speed)
Lower Limb	**Right**	**Left**	**Right**	**Left**
Draw a circle	Good	Poor, Decomposition\ jerky movement	Good	Poor to fair Decomposition\ jerky movement
Balance	**Static**	**Dynamic**	**Static**	**Dynamic**
Sitting	Good	Good	Good	Good
Standing	Eyes open: Good Eyes closed: Poor*	Poor	Eyes open: Good Eyes closed: Good	Fair
*The patient needed assistance by the therapist holding both his shoulders.				

Table-3: Showing the Timed Up and Go Test (TUG) test findings.

TUG	1st measure (1/3/2021)	2nd measure (8/3/2021)	3rd measure (15/3/2021)	4th measure (22/3/2021)
Time of getting to stand	7 s	13 s	10 s	10 s
Time of walking 3m back and forth	18 s	23 s	20 s	18 s
Time of getting to sit	4 s	6 s	5 s	5 s
Speed of walking	6m/18s= 0.33 m/s	6m/23s= 0.26 m/s	6m/20s= 0.3 m/s	6m/18s= 0.33 m/s
Loss of balance	√	√		
Short stride length	√	√	√	√
Little or no arm swing	√	√	√	√
The total time of TUG test	29 s	42 s	35 s	33 s

Table-3: Home exercise programs (HEP) advised the patient

Visit	Home Exercise programs	Duration
1	• Throwing a ball to the therapist and catching it • Throwing a ball inside the basket • Sit to stand (x4) • Walking while alternating knee lifts with each step • Standing with narrow BOS (5 sec) • Walking with obstacles • Side walking with obstacles • Side kicks • Cone drills	All exercises were performed depending on the patient's tolerance Except: - Sit to stand - Standing with narrow BOS
2	Same as the first visit except: • Standing with narrow BOS was for (7 sec)	Same as the first visit
3	Same as the second visit except: • Sit to stand (x4) • Standing with narrow BOS was for (10 sec)	Same as the second visit
4	Same as the third visit	Same as the third visit
5	Same as the third visit	Same as the third visit
6	Same as the fifth visit except: • Sit to stand (x7)	Same as the fifth visit
BOS: Base of support		

DISCUSSION

In the current case study, we looked at how physical therapy helped individuals who had had their cerebellar tumours removed feel better overall. A series of therapeutic exercises called Frenkel coordination exercises was created to treat ataxia, particularly cerebellar ataxia, enhance coordination and balance, lower the risk of falls, and lower the cost of related medical care.[11] One of the most crucial exercises for preventing falls and injuries, as well as for improving posture, strength, standing balance, and mobility, is balance training.[10] The patient had the aforementioned physical therapy as a result to enhance his current motor abilities. The TUG test was chosen as the clinical outcome measurement method because it is a valid and reliable technique that needs little equipment and can be used in confined spaces. Additionally, it is a short and simple test that aids in determining the patient's pace and risk of falling for both the patient and the therapist.[9] Patients with vertigo, arthritis, and stroke have all benefited from it over time.[7–9] The TUG test has great test-retest repeatability, according to Alghadir *et al*.[8] It can be used to assess balance and mobility in adult stroke patients as a single-task test. In comparison to tests like the Mini Balance Evaluation System Test and the Berg Balance Scale, it has also demonstrated strong validity.[7–9] As a result, the patient was instructed to do the TUG test to the best of his ability at each therapy session and each visit.

In their study, Acar & Eler[10] evaluated the impact of the 8-week balance exercises on patients' increases in speed and agility. By the end of the 8 weeks, there had been a significant improvement in 20-meter speed, agility, and balance, according to the study's findings (p-0.05). The clinical outcome described in the current case study is somewhat consistent with the earlier research. When comparing the first and second visits, the exercises' duration during the TUG test increased; however, throughout the following visits, the time decreased. There are many possible explanations for this relapse, including impaired psychological status that interferes with the patient's ability to concentrate during therapy sessions. In addition, the patient had bronchitis and had to skip six days of physical therapy in between sessions.

Table 3 details how long it took to "get to stand" in comparison to the previous tests. As previously

mentioned, the therapist gave more attention to strengthening the upper extremities, particularly the shoulder flexors, than the lower extremities, which are crucial for the "get to stand" motion. The "get to stand" exercise needs further consideration. The patient displayed a cautious walking pattern with a short stride length during the TUG test. Throughout the appointments, the patient's walking pace continued to increase, and arm swings were lost as a result of carrying a cane in one hand while the therapist supported them with the other.

A comprehensive analysis by Martin *et al.*[12] of all the research that addressed cerebellar impairment found that all the parameters assessed, particularly the patient's balance, gait, and function, were improved by physiotherapy. This is consistent with the case report's findings. The patient's TUG test results showed a significant difference, but during therapy, there was also a noticeable increase in the patient's balance, coordination, and muscle strength. This can be credited to the patient's family's strong support, a rigorous physiotherapy regimen, and firm commitment to the prescribed course of action.

CONCLUSION

According to the study, people with cerebellar dysfunction can benefit from physical therapy's positive effects on gait, balance, and coordination. The outcome of this case report highlights the requirement for carefully thought-out and well-designed randomized clinical trials that closely examine the effectiveness of tailored physiotherapy activities for people with cerebellar impairment.

AUTHORS' CONTRIBUTION

All authors were involved in the medical care of the patient and critically revised the manuscript to bring it to its final version. All authors reviewed the results and approved the final version of the manuscript.

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