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Outpatient Physical Therapy Management of Patient with Right Posterior Cerebral Artery Cerebrovascular Accident (CVA): A case study

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OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF PATIENT WITH RIGHT POSTERIOR CEREBRAL ARTERY CEREBROVASCULAR ACCIDENT (CVA): A CASE STUDY

by

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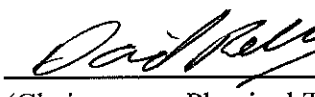
This Scholarly Project, submitted by Martina Mack in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)



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Signature Martina Mack

Date October 6, 2020

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ABSTRACT

Background and Purpose: Stroke is the number four cause of death and leading cause of disability in the United States. A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts. The purpose of this case report is to describe the interventions used for this patient and the outcome he experienced.

Case Description. The patient was a 43-year-old male who suffered a right posterior cerebral artery cerebrovascular accident (CVA) resulting in left hemiparesis, balance, and cognitive deficits.

Interventions: The patient was treated 2x/week for 6 weeks in 30-min sessions. Treatment consisted of gait training, therapeutic exercise, neuromuscular re-education, and implementation of cognitive components using multitasking activities in conjunction with occupational and speech therapy.

Outcomes. The patient had 14 physical therapy sessions. He was able to improve balance, gait, increased strength and improved cognitive deficits. The patient was able to get back to work full-time demonstrating improvements in functional mobility.

Discussion. Rationale for treatment was based on textbook information and stroke rehabilitation. The patient responded well to treatment, demonstrating compliance in home exercise program and high motivation. The use of research and patient specific interventions may have assisted in the restoration of a normal gait pattern, improvement of balance, and improvement of functional mobility and strength.

CHAPTER 1

BACKGROUND AND PURPOSE

Approximately 795 000 strokes occur each year in the United States. On average, someone in the United States will suffer a stroke every 40 seconds, and death from a stroke occurs approximately every 4 minutes. [1] Stroke is the number 4 cause of death and leading cause of disability in the United States. A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts. Therefore, the brain cannot get the blood and oxygen it needs.[2]

Loss of function varies depending on the part of the part that is affected from a stroke. Figure 1 depicts the various functions the brain controls in the human body.[3]

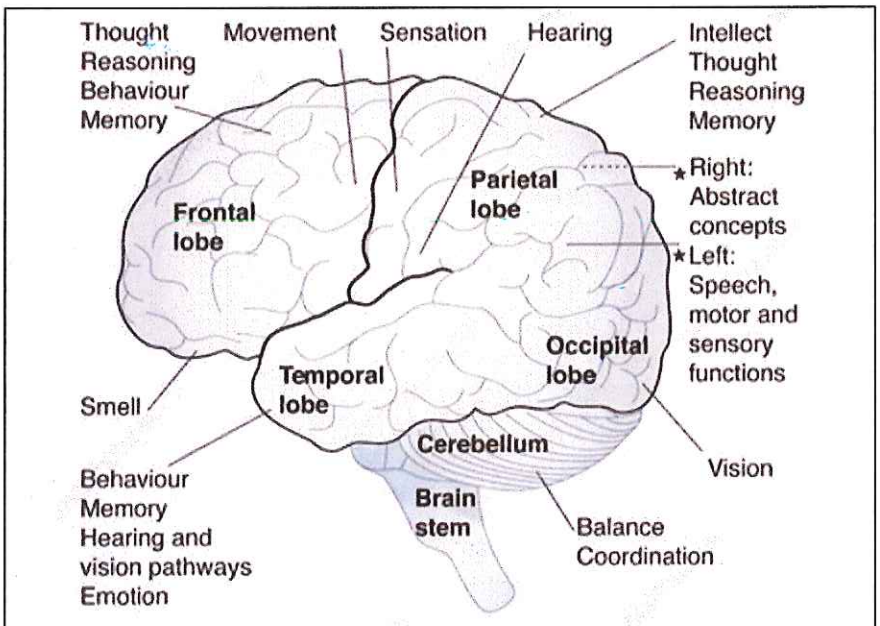

Figure 1: Functional areas of the brain.

The brain receives blood supply from two sources: the internal carotid arteries and the vertebral arteries. The internal carotid arteries branch to form the anterior and middle cerebral arteries. The right and left vertebral arteries come together at the level of the pons on the ventral surface of the brainstem to form the midline basilar artery. The basilar artery joins the blood supply from the internal carotid arteries. The posterior cerebral arteries arise there with the anterior and posterior communicating arteries. Conjoining the major sources of blood supply improves the chances of any region of the brain continuing to receive blood if one of the major arteries becomes occluded.[4] There are three major blood vessels that supply blood to the brain. There are the anterior, middle, and posterior cerebral arteries. Figure 2 represents the blood supply to the brain.[5]

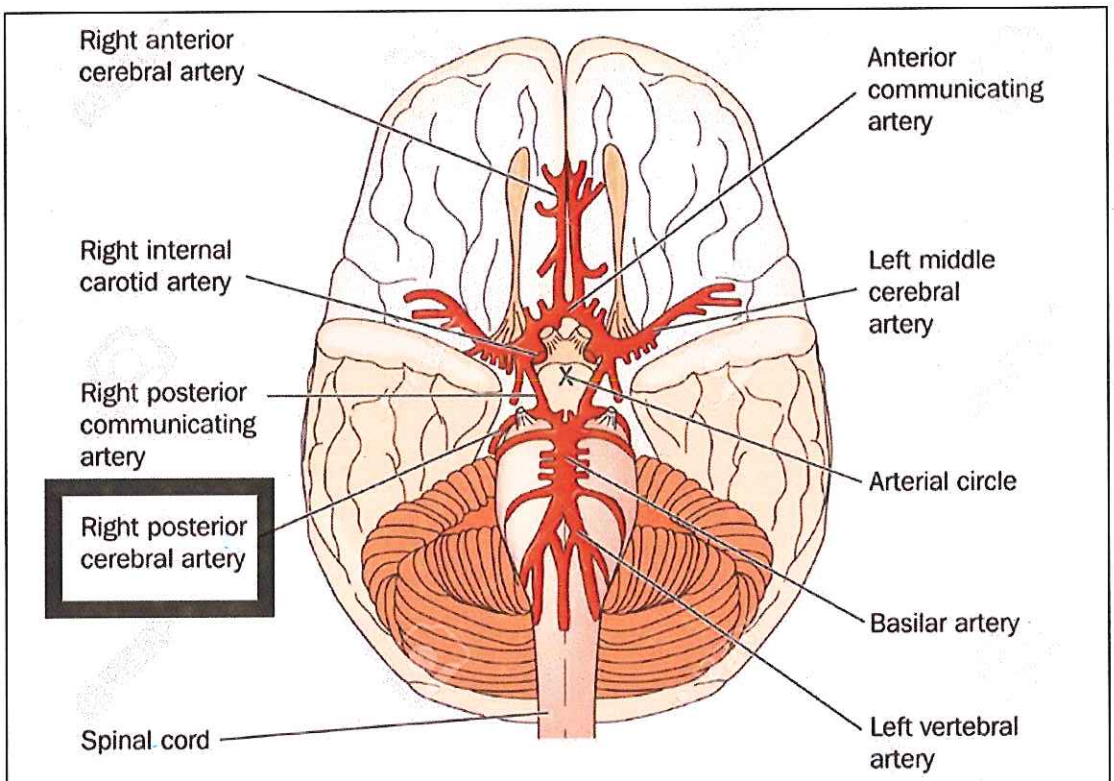

Figure 2: The major arteries of the brain showing anterior, middle, and posterior cerebral arteries.

A stroke is diagnosed using multiple tests including physical exams, blood tests, computerized tomography (CT) scans, magnetic resonance imaging (MRI) scans, echocardiogram and many others.[6] Risk factors for stroke include high blood pressure, diabetes, heart diseases, smoking, age, gender, race and ethnicity, and family history of stroke or transient ischemia attack (TIA).[6] Literature reviewed in preparation for this case included the stroke rehab clinical handbook.[7] Tests and measures were researched prior to evaluation and come from the American Physical Therapy Association (APTA) guidelines for stroke rehabilitation.[8] Stroke presentations vary so it is important to assess the individual and find out the patient's learning style in order to achieve optimal results from rehabilitation. According to The American Stroke Association (ASA), there are steps in order to achieve results, however, it is important to find specific deficits to address before progressing treatment.[8]

Common paths taken for recovery following strokes are medications including clot buster drugs and rehabilitation consisting of physical, occupational, and speech therapy. Clot buster drugs, also known as thrombolytic therapy, are medications given through an IV to break up blood clots. These powerful drugs are given to prevent the ongoing damage of heart attacks, halt ongoing damage from ischemic stroke, and break up blood clots in other blood vessels in the body.[9]

The first three months of recovery is typically when a patient sees the most improvement and gains tend to happen quickly. Some stroke survivors will continue to improve after this period; however, it will depend on if the brain stem was affected. Although they do not occur as rapidly as the first 3 months, the overall majority of improvements happen within the first 6 months. Recovery will depend on individual effort and motivation, and support from friends,

family, and healthcare professionals involved in rehabilitation.[10] Neurologic rehabilitation aims to reduce impairments and disabilities after stroke. New strategies to enhance recovery draw from a growing understanding of how types of training, progressive task-related practice of skills, exercise for strengthening and fitness, neurostimulation, and drug and biological manipulations can induce adaptations at multiple levels of the nervous system. The future of stroke rehabilitation remains one of promise and challenge in treating residual disabilities, especially for testing biological interventions for neural repair in the most profoundly affected individuals.[11]

This case report will illustrate the path taken for an individual's stroke recovery including the patient's case description, examinations, interventions, and outcomes after a CVA. The purpose of this case report is outline the path and compare it to other traditional approaches to stroke rehabilitation.

CHAPTER II

CASE DESCRIPTION

History

This patient was a 43-year-old male who suffered a right posterior cerebral artery cerebrovascular accident (CVA) affecting the posterior internal capsule resulting in left hemiparesis and cognitive deficits. He developed sudden left-sided weakness and slurred speech and was admitted to the emergency room 6 hours after sudden symptoms. He also had a history of a myocardial infarction a few years ago and significant hypertension.

Patient resides with fiancée and three kids aged 11, 13, and 18 in a multi-story house. He works as an engineer for a hotel company, which requires supervising employees, planning projects, purchasing supplies, etc. He would like to get back to full time work as soon as he can. Patient also reports he would like to do things requiring bending over like getting things out of the dryer (as he currently needs assistance) as well as being ready to complete garage work, automotive, and welding work as he states he is the "jack of all trades." The patient suffered the stroke with primary complaint being difficulty multitasking and stated he felt dizzy especially when bending over. Patient also stated he has vision issues as he is nearsighted and has concerns about getting around his home at night in the dark. He said he has left leg sensation deficits as he is unable to feel his left foot when ambulating. He stated he would like to have the energy to attend his kids' sporting activities and be able to keep up with his wife.

Examination and Evaluation

The patient's examination was based on guidelines for adult stroke rehabilitation and recovery from the American Stroke Association physical rehabilitation for stroke.[12] Upon observation, patient demonstrated difficulty balancing, asymmetrical gait pattern, impaired strength, and impaired cognition secondary to a left posterior cerebral artery stroke affecting the internal capsule. Patient signs and symptoms are consistent with those of referring diagnosis of CVA. Further testing/measures included Activities-Balance Confidence Scale (ABC Scale), BERG Balance Scale, Functional Gait Assessment (FGA), strength testing utilizing five times sit-to-stand test, and gait speed. Table 1 summarizes results from the BERG balance scale and Table 2 summarizes the FGA balance scale. Overall summary of results from all tests/measures can be found in Table 3. Manual muscle testing performed in seated position and results can be found in Table 4.

Table 1. Berg Balance Scale.

BERG Task	**Score-Assessment**
Sitting to standing	4/4
Standing unsupported	4/4
Sitting with back unsupported	4/4
Standing to sitting	4/4
Transfers	4/4
Standing unsupported with eyes closed	**2**/4
Standing unsupported with feet together	**2**/4
Reaching forward with outstretched arms while standing	4/4
Pick up object from the floor from a standing position	4/4
Turning to look behind over left and right shoulders while standing	4/4
Turn 360 degrees	4/4
Place alternate foot on step or stool while standing unsupported	4/4
Standing unsupported with 1 foot in front	**3**/4
Standing on one leg	**3**/4
Total Score	**50/56**

Table 2. Functional Gait Assessment (FGA) (using single-point cane.)

FGA Task	**Score- Assessment**
GAIT LEVEL SURFACE	1. Moderate impairment - walks 20 feet, slow speed, abnormal gait pattern, evidence for imbalance, or deviates 10-15 inches outside of the 12 inch walkway. Requires more than 7 seconds to ambulate 20 feet
CHANGE IN GAIT SPEED	2. Mild impairment-is able to change speed but demonstrates mild gait deviations, deviates 6-10 inches outside of the 12 inch walkway, or no deviations but unable to achieve a significant change in velocity, or uses an assistive device.
GAIT WITH HORIZONTAL HEAD TURNS	1. Moderate impairment-performs head turns with moderate change in gait velocity, slows down, deviates 10-15 inches outside the 12 inch walkway but recovers, can continue to walk.
GAIT WITH VERTICAL HEAD TURNS	1. Moderate impairment-performs task with moderate change in gait velocity, slows down, deviates 10-15 inches outside 12 inch walkway but recovers, can continue to walk.
GAIT AND PIVOT TURN	2. Mild impairment-pivot turns safely and greater than 3 seconds and stops with no loss of balance, or pivot turn safely within 3 seconds and stops with mild imbalance, requires small steps to catch balance.
STEP OVER OBSTACLES	2. Mild impairment-is able to step over 1 shoebox, 4.5 inches, without changing gait speed; no evidence of imbalance
GAIT WITH NARROW BASE OF SUPPORT	1. Moderate impairment-ambulates 4-7 steps,
GAIT WITH EYES CLOSED	2. Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1cm (10–15 in) outside 30.48-cm (12-in) walkway width. Requires more than 9 seconds to ambulate 6 m (20 ft)
AMBULATING BACKWARDS	2. Mild impairments-walks 20 feet, uses assistive device, slower speeds, mild gait deviations, deviates 6-10 inches outside 12 inch walkway.
STEPS	2. Mild impairment-alternating feet, must use rail.
TOTAL SCORE	**15/30** A score of 22/30 in older adults predicts unexplained falls A score of <18/20 predicts increased fall risk in Parkinson's Disease Minimal detectable change is 4 points

Table 3: Summary of Functional Assessments performed at evaluation (FGA, Berg, 5x sit-to-stand, Gait Speed, Activities Balance Confidence).

Functional Assessment	**Score**	**Normal**[1]
Functional Gait Assessment (FGA)	**15/30**	>22/30 no fall risk
Berg Balance	**50/56**	41-56 low fall risk
5x Sit to Stand	**30.65 sec**	> 12 sec fall risk
Gait Speed	**0.90 m/sec**	1.46m/sec
Activities-Balance Confidence Scale[3]	**60%**	<67%=fall risk

Table 4: Manual muscle testing performed in seated position for hip, knee, and ankle for lower extremity.

Manual Muscle Test	**Right**	**Left**
Hip Flexion	5/5	4/5
Hip Abduction	5/5	4+/5
Hip Adduction	5/5	4+/5
Knee Flexion	5/5	4+/5
Knee Extension	5/5	4/5
Dorsiflexion	5/5	4/5
Plantarflexion	5/5	5/5

The above examination tools and outcome measures are commonly used in stroke rehab. The functional gait assessment (FGA) is a 10-item gait test that comprises 7 of the 8 items from the original DGI and 3 new items, including "gait with narrow base of support," "ambulating backwards," and "gait with eyes closed."[13] According to Wrisley et al[14] concurrent validity was assessed using the correlation of the FGA scores with balance and gait measurements. Intraclass correlation coefficients of .86 and .74 were found for interrater and intrarater reliability of the total FGA scores. Internal consistency of the FGA scores was .79, which was considered appropriate to use as a functional outcome in stroke rehab. The five time sit-to-stand test was found to be a reliable measurement tool that correlates with knee flexors muscle strength but not

balance ability in subjects with stroke. Cut-off scores of 12 seconds were found to be discriminatory between healthy elderly and people with stroke at a sensitivity of 83% and specificity of 75%.[15]

According to the FGA at initial examination, patient was categorized as high fall risk demonstrating a score of 15/30 with dynamic balance being most affected. The patient was able to score 50/56 on Berg balance demonstrating low fall risk with static balance mildly affected. According to five times sit-to-stand, patient was shown to have high fall risk with a time of 30.65 seconds for five sit-to-stands using hands (cut-off 12 seconds to have no fall risk). Both five times sit-to-stand and manual muscle testing confirmed muscle weakness for functional mobility and more specifically left sided hemiparesis demonstrating consistent strength deficits on the left side. Gait speed results of 0.90 m/sec were low showing patient is not at the speed required for community ambulation. According to the ABC scale, patient demonstrated decreased confidence of 60%.[16] Functional assessments showed objective measures for decreased balance, impaired gait, decreased strength and functional mobility, and visual and cognitive impairments. Assessment of functional outcomes at initial evaluation were done in order to address impairments and be able to track improvements throughout treatment of physical therapy.

Prognosis and Plan of Care

The patient's problems were identified using the above functional assessments, therefore showing objective measures for decreased balance, impaired gait, decreased strength and functional mobility, and visual and cognitive impairments. Figure 3 below shows the International Classification of Functioning, Disability, and Health (ICF) model to represent the patient's problem list including body structure/function, activity limitations, participation

restrictions, and environmental and personal factors associated with patient plan of care. The ICF model is a global, general purpose instrument that is the framework used by the World Health Organization (WHO) to gauge health at the individual and group levels.[17] According to Zhang et al, [18] the ICF model rehabilitation is a valuable assessment instrument that is compatible with commonly used clinical assessment scales for stroke.

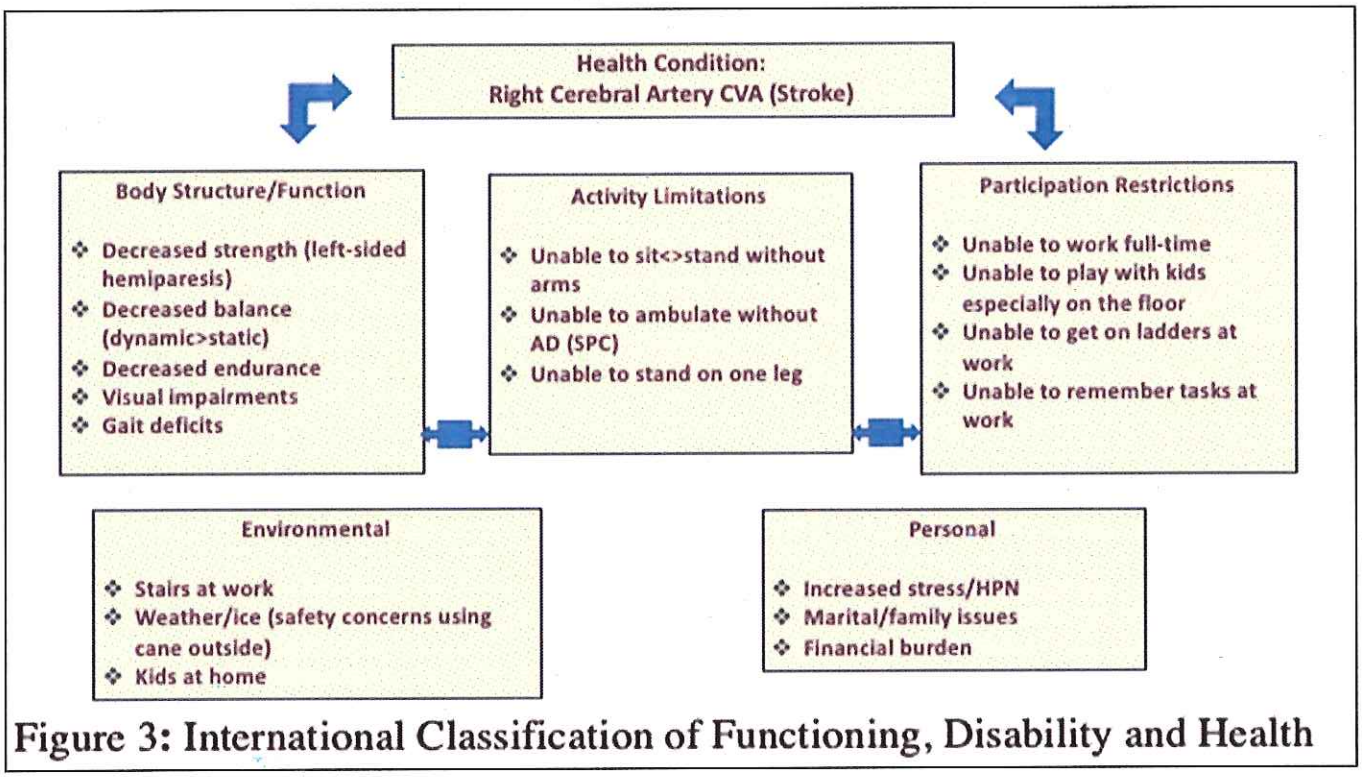

Figure 3: International Classification of Functioning, Disability and Health

The treatment was facilitated twice a week for 6 weeks including the evaluation and discharge session. The physical therapy goals for this patient are listed below:

Short-term Goals: (to be accomplished within 3 weeks):

1. The patient will be independent and compliant with home exercise program for strength and balance activities.

2. The patient will progress from part-time (4 hours) to full time (8 hours) performing daily job duties without any setbacks in strength or gait.
3. The patient will ambulate with no assistive device for 25 feet to be able to effectively mobilize around home.

Long-term goals: (to be accomplished within 6 weeks):

1. The patient will demonstrate an increase of at least 10% on the Activities Balance Confidence Scale.
2. The patient will demonstrate a decrease of at least 5 seconds on the 5 time sit to stand test.
3. The patient will demonstrate an increase of at least 8 points on the FGA to decrease fall risk (>22/30 no fall risk).

Discharge criteria required meeting the long term goals and returning to full function in his everyday life. The plan of care consisted of gait training, neuromuscular re-education, balance training, and the use of multitasking in addition to conventional treatment. His prognosis was predicted to be good as long as patient consistently communicated with cardiology in regard to medication to maintain hypertension and attended all therapies. The patient was likely to recover to full function with help from speech, occupational, and physical therapy. Goals were set to continue to work his engineering job at the same pace and same hours prior to CVA.

CHAPTER III

INTERVENTIONS

The patient was seen two days a week for 30-minute sessions for 6 weeks. The first week's interventions involved gait training and beginning the transition from single-point cane use to using no assistive device. Patient educated on symmetrical step length and gait pattern demonstrating heel to toe steppage. Gaze stabilization and vestibular ocular reflex exercises were also implemented to improve visual acuity with movement. After one week, the patient was only utilizing single-point cane for longer distances, but transitioned into not using assistive device at home and at work.

The second and third week of treatment included balance and coordination activities utilizing the "karaoke" walk requiring balance, cognition, and coordination. A breakdown of the components was done in order to progress into the full walk. Components were first performed in parallel bars for support including sidestepping, cross-over stepping, and cross-under stepping. Double and single-leg balance exercises were implemented to improve both static and dynamic balance.

The fourth week of treatment included the Multiple Tasks Test, which is based on simultaneous assessments of multiple postural components, representing everyday situations that can be applied by clinicians. Situations were related to patient duties at work and activities of daily living. These components were combined to yield eight separate tasks of increasing complexity that were executed sequentially. Patient required two attempts to execute correctly

while following all given directions, without asking the therapist for assistance. This incorporated functional tasks along with physical components to improve both cognition and memory.[19] Below Table 5 shows an example of tasks given to patient. Patient was asked to discuss strategies in order to accomplish all tasks in order.

Table 5: Multiple Tasks Test			
Test 1	1. Find glass of water and fill up	2. Put #10 weight on top shelf	3. Find out clinic hours

The fifth week of treatment interventions included floor transfers as patient had stated this was a functional concern at home in caring for his children. Floor transfers were broken down into separate components to execute in order to properly get up and down off the floor. Home exercise program included standard forward lunges and single leg sit-to-stands to improve strength in order to help with floor transfers.

The final week of treatment included re-testing baseline measures to assess building home exercise program to improve strength for patient to perform at home and start transitioning into a workout regimen at a nearby gym. Patient was given functional exercises to complete at home including squats, lunges, lateral step downs, and single-leg balance exercises.

CHAPTER IV

OUTCOMES

The patient was seen two times a week for 6 weeks of 30-min sessions and progressively saw improvements every week at physical therapy. Table 6 represents the baseline measurements retested prior to discharge and normal for comparison. His balance improved from a high fall risk according to FGA and Berg to no fall risk showing no deficits using no assistive device. The patient was able to accurately perform the "carioca," a braiding/weaving lateral movement showing a high level of dynamic balance and coordination. Improvements were made in all functional assessments as recorded below. He was able to improve functional assessments to normal or no fall risk including perfect scores for functional gait assessment, Berg balance test, as well as decreasing 5x sit to stand by 50%, increasing gait speed by 50%, and increasing ABC Scale to 95%.

Table 6: Summary of Functional Assessments performed at evaluation (FGA, BERG, 5x sit-to-stand, Gait Speed, Activities Balance Confidence).

Functional Assessment	**Initial Score**	**Discharge Score**	**Normal**
Functional Gait Assessment (FGA)	15/30	**30/30**	>22/30 no fall risk
Berg Balance	50/56	**56/56**	41-56 low fall risk
5x Sit to Stand	30.65 sec	**11.83 sec**	> 12 sec fall risk
Gait Speed	0.90 m/sec	**1.86 m/sec**	1.46m/sec
Activities-Balance Confidence Scale	60%	**95%**	<67%=fall risk

CHAPTER V

DISCUSSION

The patient showed compliance in a home exercise program and high motivation to return to full function of work components and activities of daily living. He demonstrated no balance deficits, improved strength from decreased five times sit to stand time, improved gait speed, and a reported 95% on the Activities-Balance Confidence Scale. The patient did receive occupational and speech therapy to address cognitive and fine motor deficits, which contributed to patient's success in the rehab process. The combination of gait and balance training, strengthening exercises, gaze stabilization, and the added benefits of speech and occupational therapy gave the patient the tools and strategies to efficiently return to full function. He was able to meet all short and long-term goals during six weeks of rehabilitation. He was able to return to all functional activities including working full time as an engineer and being able to participate in facility activities.

Gaze stabilization exercises seemed to play a huge role in balance improvements and improving FGA score. A 2017 study aimed to investigate whether or not vestibular rehabilitation would improve both the vestibulo-ocular reflex and gait performance of patients with post stroke hemiparesis.[20] The results indicated that vestibular rehabilitation could improve post stroke patients' vestibulo-ocular reflex. Moreover, patients might show improved gait performance after using vestibular interventions due to the change of vestibular input. The addition of gaze stabilization exercises implemented with gait training helped the patient feel less dizzy, better

able to balance while walking, and able to complete work activities that included turning head in multiple directions.

He was able to complete multiple task tests with less difficulty after utilizing strategies for better cognition in conjunction with physical activities. According to Bloem et al, [19] motor learning influenced performance among subjects who received the multiple systems tasks test. Dual-task training also could have contributed greatly to his success by utilizing the multiple systems task test and supplementing therapy with a cognitive component. According to Pang et al[22] study examining the effects of dual-task exercising of chronic stroke patients, the dual-task program was effective in improving dual-task mobility and reducing falls and fall-related injuries in ambulatory chronic stroke patients with intact cognition. He responded well to cognitive tasks and dual-task exercises and ensured us that it was positively making a difference in his everyday life and at work. Muscle strengthening played a huge role in the rehab for this patient as he initially demonstrated hemiparesis on his left side, which contributed to impaired gait performance including gait speed, asymmetry, and endurance. According to a study by Wist et al,[23] progressive resistance training seemed to be the most effective treatment to improve strength. Exercises in his home exercise including squats, lunges, lateral step downs, and single-leg balance exercises could have contributed to improved strength and improve gait performance. He reported he felt stronger and was better able to performance activities with his kids more easily.

In conclusion, individuals who suffer from strokes may face many variables to affect recovery. Due to this patient's age and motivation, he was able to return to full function. According to Veerbeck et al,[21] there is strong evidence for physical therapy interventions

favoring intensive high repetitive task-oriented and task-specific training in all phases post stroke. Effects are mostly restricted to the actually trained functions and activities. The use of research and patient specific interventions assisted the patient in giving him the opportunity of restoration of a normal gait pattern, improvement of balance, and improvement of functional mobility and strength.

Reflective Practice

In retrospect to this patient's care, there are few changes I would have made in regard to the patient's interventions over the six weeks of treatment. Working in conjunction with speech and occupational therapy allowed us to build our treatment plans together for optimal effectiveness. However, since the treatment sessions were 30 min, interventions were cut short due to taking vitals for patient's severe hypertension. Other interventions that could have been used include mirror therapy and more vestibular activities for improved balance. More balance assessments could have been used rather than just the FGA for dynamic balance. A good balance measure that could have been utilized is the Mini Balance Evaluation Systems Test (Mini-BESTest).[24]

Although there could have been changes or additions to this patient's interventions and evaluations, the patient's case was ultimately managed well. He was able to show improvement both subjectively and objectively from tests and measures performed throughout treatment. All of the patient's goals were met in order to return to full function of activities of daily living and work duties. The conjunction of physical therapy with speech and occupational therapy was critical in ensuring the best recovery for this patient. All therapies provided appropriate and

necessary treatment interventions to assist in reaching patient's goals. He was overall satisfied with his 6 weeks in physical therapy.

APPENDIX

The Activities-specific Balance Confidence (ABC) Scale

For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:

0% 10 20 30 40 50 60 70 80 90 100%
no confidence completely confident

"How confident are you that you will not lose your balance or become unsteady when you…
…walk around the house? ____%
…walk up or down stairs? ____%
…bend over and pick up a slipper from the front of a closet floor ____%
…reach for a small can off a shelf at eye level? ____%
…stand on your tiptoes and reach for something above your head? ____%
…stand on a chair and reach for something? ____%
…sweep the floor? ____%
…walk outside the house to a car parked in the driveway? ____%
…get into or out of a car? ____%
…walk across a parking lot to the mall? ____%
…walk up or down a ramp? ____%
…walk in a crowded mall where people rapidly walk past you? ____%
…are bumped into by people as you walk through the mall?____%
… step onto or off an escalator while you are holding onto a railing? ____%
… step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? ____%
…walk outside on icy sidewalks? ____%

Functional Gait Assessment

1. GAIT LEVEL SURFACE

Instructions: *Walk at your normal speed from here to the next mark (6 m [20 ft]).*

Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft) in less than 5.5 seconds, no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment—Walks 6 m (20 ft) in less than 7 seconds but greater than 5.5 seconds, uses assistive device, slower speed, mild gait deviations, or deviates 15.24–25.4 cm (6–10 in) outside of the 30.48-cm (12-in) walkway width.

(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, or deviates 25.4–38.1 cm (10–15 in) outside of the 30.48-cm (12-in) walkway width. Requires more than 7 seconds to ambulate 6 m (20 ft).

(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside of the 30.48-cm (12-in) walkway width or reaches and touches the wall.

2. CHANGE IN GAIT SPEED

Instructions: *Begin walking at your normal pace (for 1.5 m [5 ft]). When I tell you "go," walk as fast as you can (for 1.5 m [5 ft]). When I tell you "slow," walk as slowly as you can (for 1.5 m [5 ft]).*

Grading: Mark the highest category that applies.

(3) Normal—Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast, and slow speeds. Deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment—Is able to change speed but demonstrates mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside of the 30.48-cm (12-in) walkway width, or no gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.

(1) Moderate impairment—Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, deviates 25.4–38.1 cm (10–15 in) outside the 30.48-cm (12-in) walkway width, or changes speed but loses balance but is able to recover and continue walking.

(0) Severe impairment—Cannot change speeds, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width, or loses balance and has to reach for wall or be caught.

3. GAIT WITH HORIZONTAL HEAD TURNS

Instructions: *Walk from here to the next mark 6 m (20 ft) away. Begin walking at your normal pace. Keep walking straight; after 3 steps, turn your head to the right and keep walking straight while looking to the right. After 3 more steps, turn your head to the left and keep walking straight while looking left. Continue alternating looking right and left every 3 steps until you have completed 2 repetitions in each direction.*

Grading: Mark the highest category that applies.

(3) Normal—Performs head turns smoothly with no change in gait. Deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment—Performs head turns smoothly with slight change in gait velocity (eg, minor disruption to smooth gait path), deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width, or uses an assistive device.

(1) Moderate impairment—Performs head turns with moderate change in gait velocity, slows down, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk.

(0) Severe impairment—Performs task with severe disruption of gait (eg, staggers 38.1 cm [15 in] outside 30.48-cm (12-in) walkway width, loses balance, steps, or reaches for wall).

4. GAIT WITH VERTICAL HEAD TURNS

Instructions: *Walk from here to the next mark (6 m [20 ft]). Begin walking at your normal pace. Keep walking straight, after 3 steps, tip your head up and keep walking straight while looking up. After 3 more steps, tip your head down, keep walking straight while looking down. Continue alternating looking up and down every 3 steps until you have completed 2 repetitions in each direction.*

Grading: Mark the highest category that applies.

(3) Normal—Performs head turns with no change in gait. Deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment—Performs task with slight change in gait velocity (eg, minor disruption to smooth gait path), deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width or uses assistive device.

(1) Moderate impairment—Performs task with moderate change in gait velocity, slows down, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk

(0) Severe impairment—Performs task with severe disruption of gait (eg, staggers 38.1 cm [15 in] outside 30.48-cm (12-in) walkway width, loses balance, steps, reaches for wall).

5. GAIT AND PIVOT TURN

Instructions: *Begin with walking at your normal pace. When I tell you, "turn and stop," turn as quickly as you can to face the opposite direction and stop.*

Grading: Mark the highest category that applies.

(3) Normal—Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild impairment—Pivot turns safely in >3 seconds and stops with no loss of balance, or pivot turns safely within 3 seconds and stops with mild imbalance, requires small steps to catch balance.

(1) Moderate impairment—Turns slowly, requires verbal cueing, or requires several small steps to catch balance following turn and stop.

(0) Severe impairment—Cannot turn safely, requires assistance to turn and stop.

6. STEP OVER OBSTACLE

Instructions: *Begin walking at your normal speed. When you come to the shoe box, step over it, not around it, and keep walking.*

Grading: Mark the highest category that applies.

(3) Normal—Is able to step over 2 stacked shoe boxes taped together (22.86 cm [9 in] total height) without changing gait speed; no evidence of imbalance.

(2) Mild impairment—Is able to step over one shoe box (11.43 cm [4.5 in] total height) without changing gait speed; no evidence of imbalance.

(1) Moderate impairment—Is able to step over one shoe box (11.43 cm [4.5 in] total height) but must slow down and adjust steps to clear box safely. May require verbal cueing.

(0) Severe impairment—Cannot perform without assistance.

_____7. GAIT WITH NARROW BASE OF SUPPORT

Instructions: *Walk on the floor with arms folded across the chest, feet aligned heel to toe in tandem for a distance of 3.6 m (12 ft). The number of steps taken in a straight line are counted for a maximum of 10 steps.*
Grading: Mark the highest category that applies.

(3) Normal—Is able to ambulate for 10 steps heel to toe with no staggering.
(2) Mild impairment—Ambulates 7–9 steps.
(1) Moderate impairment—Ambulates 4–7 steps.
(0) Severe impairment—Ambulates less than 4 steps heel to toe or cannot perform without assistance.

_____8. GAIT WITH EYES CLOSED

Instructions: *Walk at your normal speed from here to the next mark (6 m [20 ft]) with your eyes closed.*
Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft), no assistive devices, good speed, no evidence of imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 7 seconds.
(2) Mild impairment—Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 9 seconds but greater than 7 seconds.
(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width. Requires more than 9 seconds to ambulate 6 m (20 ft).
(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

_____9. AMBULATING BACKWARDS

Instructions: *Walk backwards until I tell you to stop.*
Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft), no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.
(2) Mild impairment—Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width.
(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width.
(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

_____10. STEPS

Instructions: *Walk up these stairs as you would at home (ie, using the rail if necessary). At the top turn around and walk down.*
Grading: Mark the highest category that applies.

(3) Normal—Alternating feet, no rail.
(2) Mild impairment—Alternating feet, must use rail.
(1) Moderate impairment—Two feet to a stair; must use rail.
(0) Severe impairment—Cannot do safely.

TOTAL SCORE: _____ MAXIMUM SCORE 30

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*Adapted from Dynamic Gait Index.† Modified and reprinted with permission of authors and Lippincott Williams & Wilkins (http://lww.com).

BERG BALANCE TESTS AND RATING SCALE

Patient Name _____
Date _____
Location _____
Rater _____

ITEM DESCRIPTION SCORE (0-4) Sitting to standing _____ Standing unsupported _____ Sitting unsupported _____ Standing to sitting _____ Transfers _____ Standing with eyes closed _____ Standing with feet together _____ Reaching forward with outstretched arm _____ Retrieving object from floor _____ Turning to look behind _____ Turning 360 degrees _____ Placing alternate foot on stool _____ Standing with one foot in front _____ Standing on one foot _____ TOTAL _____

GENERAL INSTRUCTIONS
Please demonstrate each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if the time or distance requirements are not met, if the subject's performance warrants supervision, or if the subject touches an external support or receives assistance from the examiner. Subjects should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5 and 10 inches (5, 12 and 25 cm). Chairs used during testing should be of reasonable height. Either a step or a stool (of average step height) may be used for item #12.

1. SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hands for support.
( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or to stabilize
( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding.
( ) 4 able to stand safely 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unassisted

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assistance to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chairs(s) for a pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cueing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding.

( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand for 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds with feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the finger reaches while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
( ) 4 can reach forward confidently >25 cm (10 inches)
( ) 3 can reach forward >12 cm safely (5 inches)
( ) 2 can reach forward >5 cm safely (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.
( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only in 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cueing
( ) 0 needs assistance while turning

12. PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.
( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in >20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete >2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width)

( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead of other independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding.

( ) 4 able to lift leg independently and hold >10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold = or >3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently
( ) 0 unable to try or needs assist to prevent fall

TOTAL SCORE (Maximum = 56: _____

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