5-2021

Outpatient Physical Therapy Management of a Patient Diagnosed with a Severe Left Cerebrovascular Accident (CVA): A Case Study

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OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF PATIENT DIAGNOSED WITH A SEVERE LEFT CEREBROVASCULAR ACCIDENT (CVA): A CASE STUDY

by

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A Scholarly Project

Submitted to the Graduate Faculty

of the

Department of Physical Therapy

School of Medicine & Health Sciences

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota

May
2021

This Scholarly Project, submitted by Jayce Turner 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.

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PERMISSION

Title OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF PATIENT DIAGNOSED WITH A SEVERE LEFT CEREBROVASCULAR ACCIDENT (CVA): A CASE STUDY

Department Physical Therapy

Degree Doctor of Physical Therapy

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Date 10/15/20

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ACKNOWLEDGEMENTS

I would like to thank everyone who has played a role in my academic accomplishments and progress. First of all, I would like to thank my parents for their unconditional, unwavering support in my pursuit of a Doctor in Physical Therapy degree. Without you both, I would not be where I am today. Secondly, I would like to thank my academic advisor, Assistant Professor Emily Henneman, PT, DPT, for her guidance and considerations when writing this scholarly project. I would also like to extend thanks and acknowledgement to the faculty of the University of North Dakota physical therapy program for their continued efforts to ensure I receive the best education possible. Lastly, I would like to thank my peers for their assistance and cooperation throughout graduate school.

ABSTRACT

Background and Purpose: This article outlines a six-month rural/outpatient physical therapy treatment of a 58-year old female who endured a severe left cerebrovascular accident (CVA) eight months ago. Patient presents with muscle weakness, numbness, reduced tone, notable spasticity, and impaired coordination on her R side as well as impaired language, limited to say "yes" or "no". Prognosis for the patient was fair, and she is expected to regain minimal prior level of functioning. The purpose of this article is to describe the interventions used for this patient and the consequences they had.

Description: The treatment performed during the course of therapy included: therapeutic exercises for strengthening and ROM, gait training, therapeutic activities and manual work to improve patient's ability to transition, walk and perform ADLs.

Outcomes: Following physical therapy intervention, patient was able to ambulate in community with CGA, walk up stairs with CGA, independently stand, demonstrated reduced spasticity, and showed improved tone/coordination. She had reached all her goals set for her and regained more function than what the doctors initially expected.

Discussion: Rationale for treatment was based on motor control theories of neuromuscular dysfunction as well as treating the patient's physical impairments using textbook methods of strengthening and stretching. Treatment was structured to promote independence in patient's life and was modified based off patient's response.

CHAPTER I

BACKGROUND AND PURPOSE

A cerebrovascular accident (CVA) or "stroke" is a blockage or rupture of blood flow to the brain leading to cell death due to lack of oxygen. The consequences of a stroke depend on the location in the brain, the severity of cell death, and the type of stroke. There are three main types of stroke: intracerebral hemorrhage, subarachnoid hemorrhage, and ischemic. An intracerebral hemorrhage stroke is caused by an abrupt rupture of an artery inside the brain, leading to the compression of cerebral structures within. A subarachnoid hemorrhage is when blood floods into the subarachnoid space, increasing the pressure exerted onto the brain and damaging cerebral tissue. The third and most common type of CVA is an ischemic stroke, which is caused by a blockage or clot in an artery that supplies the brain.[1] This case report will focus on an individual following an ischemic stroke.

Cerebrovascular accidents affect over 795,000 people in the United States every year with 610,000 of those being the person's first.[2] Strokes typically occur in individuals over the age of 65 but can happen at any age, especially if one has a family history with CVA's.[1] African Americans and Hispanics are at an elevated risk to endure a first time CVA, as well as endure the highest mortality rates.[2] Women are at an increased rate when compared to men with roughly 55,000 more female cases per year.[1] Medical conditions that place one at a higher risk include diabetes, hypertension, heart disease, and a past history of a stroke. Omitting tobacco and alcohol use, getting adequate exercise, and maintaining healthy weight are three major lifestyle modification that can significantly reduce the chances of a stroke.[1]

Signs and symptoms of a CVA are dependent on the area of the brain affected as well as the severity in the reduction of blood flow. Symptoms include, but are not limited, to spontaneous muscle weakness and spasticity, slurred vision and speech, impaired coordination, and numbness/sensory loss.[1] There are five early signs and symptoms of a stroke: acute onset of numbness, confusion, vision problems, dizziness or difficulty walking, and headache with no known cause.[3] Educating at-risk patients about these signs and symptoms may decrease the time it takes for one to seek medical attention after the onset of a stroke; thus, leading to a better prognosis for recovery.

The diagnosis of a stroke will consist of a physical examination and a computed tomography (CT) scan, which will help rule out other conditions, as well as give a location of the affected area(s). The doctor may also suggest magnetic resonance imaging (MRI) to determine the severity of damage to soft tissue structures, and a functional MRI to assess current blood flow and perfusion[4]. The doctor will treat the block through the use of medication or surgery depending on how the patient presents and their response to conservative treatments. If an individual can seek medical treatment within a few hours after suffering a stroke, they may benefit from a tissue Plasminogen Activator (tPA). A tPA is a thrombolytic or "clot buster" that quickly dissolves a blood clot within the brain, allowing normal circulation. Patients with uncontrolled hypertension, a history of recent trauma or surgery, a recent head injury, and/or have a history of bleeding problems are at an increased risk of negative side effects from thrombolytic treatment and may be ineligible to receive a tPA.[5]

The prognosis for a patient following a stroke is dependent on multiple factors, making it difficult to determine what the exact outcomes will be. An individual's recovery varies on the location of the stroke, age, severity, personality before the stroke, prior level of function, time it

took to seek medical attention, environment, external support, motivation, and other comorbidities.[6] For location, there are five vascular syndromes that may cause a stroke. Anterior cerebral artery (ACA) syndrome involves the first of two terminal branches from the internal carotid artery. The ACA supplies the frontal and parietal lobes and subcortical structures. Distal lesions are more severe than proximal lesions since proximal lesions still allow some perfusion within the artery. Common impairments with ACA syndrome include contralateral hemiparesis and sensory loss, specifically in the lower extremity. Middle cerebral artery (MCA) syndrome in the second branch from the internal carotid artery and supplies the frontal, temporal, and parietal lobes as well as subcortical structures. Proximal occlusion of the MCA results in significant neurological damage and cerebral edema. Common impairments include contralateral spastic hemiparesis and sensory loss of the face and upper and lower extremities with more severe impairment on the upper extremity. Left side involvement of the MCA may produce aphasia and right sided occlusion may produce perceptual deficits, such as left side neglect. Internal carotid artery (ICA) syndrome produces large infarction in the areas of the brain supplied by the ACA and MCA. Edema is often observed with a chance of uncal herniation, coma, or death. The posterior cerebral artery (PCA) is a terminal branch off the basilar artery and supplies blood to the occipital lobes, medial and inferior temporal lobes, midbrain, posterior diencephalon, and upper brainstem. Just like the ACA, proximal occlusion is a better prognosis than distal occlusion. Frequent impairments include vision impairments, memory deficits, hemiplegia, spontaneous pain, and involuntary movements. The last syndrome concerns the vertebrobasilar arteries which branch from the subclavian artery. The vertebral arteries supply the medulla and cerebellum, and the basilar artery supplies the pons, the cerebellum, and internal ear. Occlusion in the vertebrobasilar system generates a vast array of symptoms, which may be ipsilateral or

contralateral. More severe impairments include quadriplegia, coma, ataxia, visual impairments, and paralysis of the muscles of mastication.[7] Figure 1 and figure 2 depict the anatomy of the blood vessels of the brain.

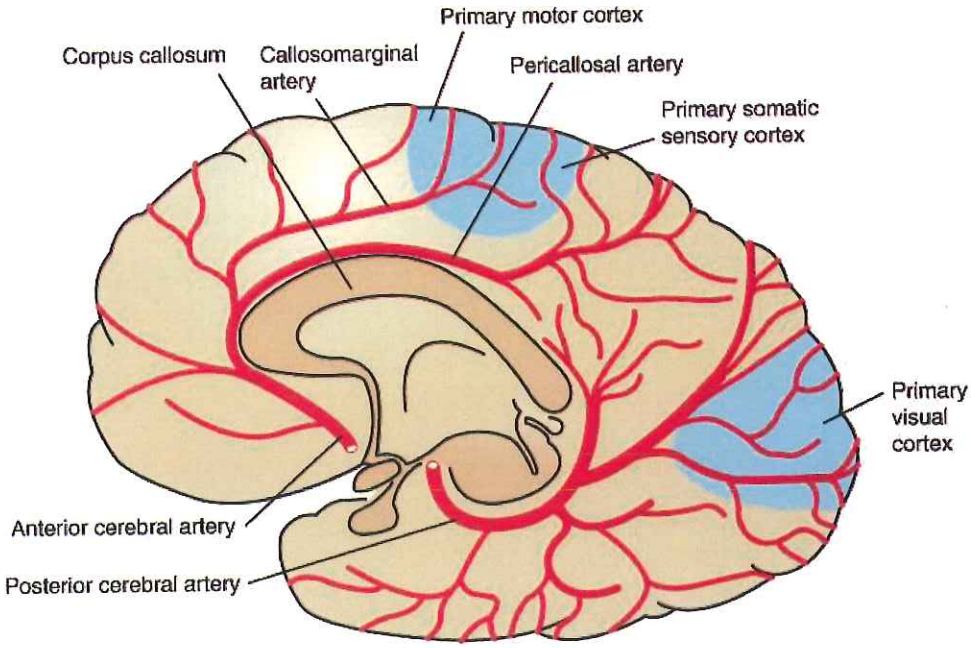


Figure 1: Anterior and Posterior Cerebral Arteries[7]

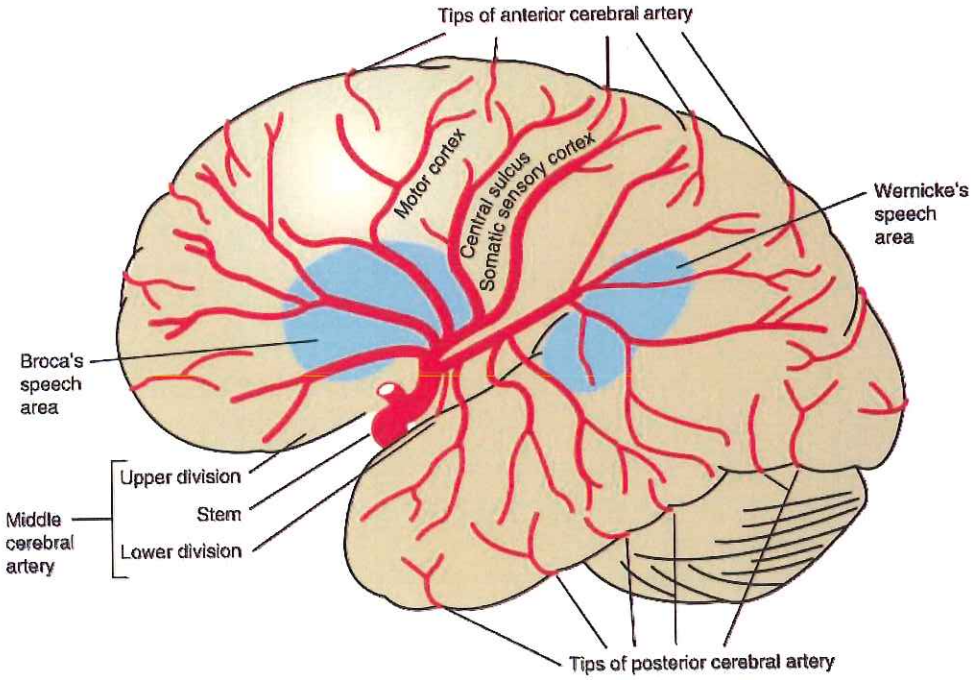


Figure 2: Middle Cerebral Artery[7]

The older someone is the less likely one is to regain prior levels of function as the body takes longer to recover and regenerate. Coping with one's new current level of functioning can be a challenge and may lead to depression, frustration, and a lack of motivation. Addressing these emotions early is critical to improve positive outcomes as patients may lose the motivation to improve. Language may also be a barrier if the left temporal lobe of the brain, as seen in Figure 3, is damaged and can perpetuate these negative emotions. The prognosis for this patient will be discussed later in the report.

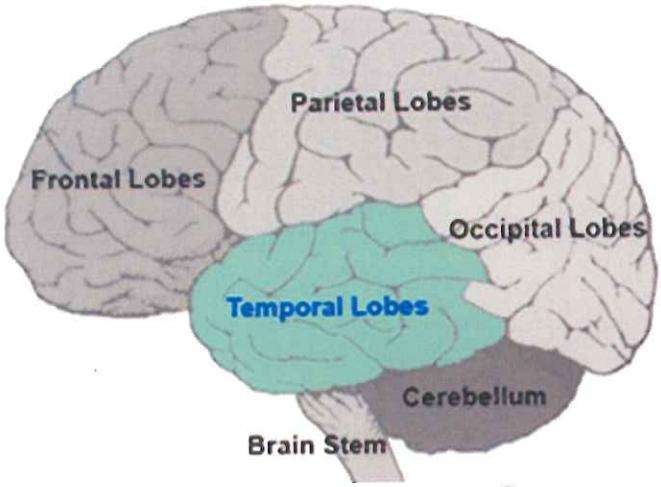


Figure 3: Cranial Lobes[8]

An interdisciplinary approach is frequently utilized due to the numerous body systems affected. Depending on severity, one can expect to work with a neurologist, physical therapist, occupational therapist (OT), speech-language pathologist (SLP), social worker, psychologist, rehabilitation nurse, and dietitian.[4] Care may be divided into three phases: acute, sub-acute, and chronic with the timeline in each phase varying case to case. The acute phase lasts anywhere from 2 to 12 weeks. Most recovery is seen in the acute phase of a stroke, making it important to receive physical and neurological rehabilitation as soon as possible. During this time, interventions are structured around compensatory function if previous function cannot be obtained. One may also experience a phenomenon called spontaneous recovery where the brain

will randomly rediscover a skill that was lost due to the stroke.[9] Spontaneous recovery was not observed with the patient presented in the study. The sub-acute phase, which is between 3 to 9 months post-CVA, primarily focuses on regaining moderate levels of function. For instance, a patient in the sub-acute phase may work on sit to stands or pivot transfers, as well as begin to ambulate longer distances, so the patient doesn't require help safely walking around their home. Depending on the level of recovery, the patient may be able to return home with the help of a caregiver, or the patient may be placed into a skilled nursing facility to be safe. The sub-acute phase can be frustrating, because after the six-month mark, recovery tends to plateau or even regress, making it important for the rehabilitation team to adapt and modify the plan of care. In more severe cases, the chronic phase begins around the 9 to 12-month mark and progress is often slowed. The main focus of this phase is to maintain and monitor signs and symptoms; however, with the support of PT, OT, and SLP, an individual may see recovery of new skills as far as two years post CVA.[9]

Physical therapy is a major component to the patient's recovery. Post-CVA rehabilitation will start as soon as the patient is medically stable to maximize positive outcomes. Therapy will revolve around regaining prior levels of function or developing compensatory methods if prior levels cannot be obtained. Research and evidence-based practice serve as guides for the physical therapist when designing the plan of care for a patient following a CVA. Lee & Stone[10] conducted a meta-analysis to quantify the effects of exercise training on cardiorespiratory fitness, muscle strength, and walking capacity after stroke. Analysis found that the combination of resistance, aerobic, and gait training will lead to a larger improvement in function and a higher quality of life. Peurala et al.[11] reviewed 38 randomized-controlled trials and concluded that gait training not only improves walking functions but also carries over to improvements in self-care

overall. The meta-analysis compared skilled therapy to a placebo/no treatment and found high evidence for the need of physical therapy in the acute, sub-acute and chronic stages of treatment as patients continue to make significant clinical improvements with gait and ADLs.[11]

The purpose of this report is to discuss and review the efficacy and decision-making of physical therapy when working with a cerebrovascular accident in an outpatient clinical setting. The report will demonstrate that physical therapy is beneficial to patients in the sub-acute and chronic phases in terms of improved gait, reduced spasticity, and an overall improvement in function.

CHAPTER II

CASE DESCRIPTION

The patient featured in this case is a 58-year old female who presents to outpatient physical with a treatment diagnosis of right-sided hemiplegia and impaired speech. The patient experienced a left ischemic CVA in September of 2018 and has been residing in a skilled nursing home since December. The patient demonstrates gross unilateral, upper and lower extremity weakness, numbness, impaired coordination, reduced range of motion (ROM), and spasticity on the right side. Communication is limited to "yes/no" responses and has trialed but chooses not to use an assistive device for communication. Previous physical therapy was focused on walking with a platform walker with moderate assistance for right leg progression as well as electrical stimulation, which held no long-term benefit. She does have an ankle-foot orthosis (AFO) but does not like to use it due to discomfort. Her husband and sister are greatly involved with her physical and occupational rehabilitation and act as sturdy external supports for the patient. As a retired schoolteacher, she had no limitations in her prior level of function and enjoyed to garden and dance with her husband. Her current level of function requires minimal to moderate assistance with functional activities. She used to smoke and lived a sedentary life with nothing abnormal in her family history. The chief complaint is generalized weakness and reduced level of overall function. Patient and family goals are to be able to safely discharge back to home and to recover moderate independence with self-care activities of daily living (ADLs). A review of systems reveals nothing noteworthy except for slightly elevated blood pressure that does not yet require the use of medications. The patient has struggled with bouts of depression since her CVA

but is not being treated with medication at this time. She does not have any other known comorbidities. Evaluation was done in the clinic, and the following information portrays the examination procedure and results.

EXAMINATION

Physical therapy examination was based off O'Sullivan and Schmidt[12] for a neurological pathology and looked to evaluate gross motor function. The patient was assessed on a combination of static control, dynamic control, gross muscle strength, gross ROM, coordination, and balance. Gross muscle strength testing was 3+/5 on the left and was deferred on the right as patient was unable to follow commands. ROM was assessed with the patient in supine and was normal on the left with a 50% deficit for gross movements, such as overhead arm movements and hip flexion, on the right. To coincide with limited ROM, the patient demonstrates elbow flexion and ankle inversion contractures on the right. Numbness is experienced throughout the right side of the body, and the patient denies any pain. Modified Ashworth (which can be seen in Appendix A) testing showed 2/4 spasticity, meaning a catch is felt halfway through the motion, with arm flexion, elbow extension, and ankle dorsiflexion. A functional assessment was performed on the following movements: supine-to-sit, sit-to-stand, stand-to-sit, standing pivot transfer, static standing, walking, and stairs. The results for these movements can be seen in Table 1.

Table 1: Functional Assessment at Initial Evaluation

Task	Assistance required	Other comments
Supine-to-sit	Minimal-moderate x 1	Shows core/upper extremity (UE) weakness, does not use R side
Sit-to-stand	Minimal x 1	Vocal cue (v/c) to push with her legs and not use arms, does not use right side
Stand-to-sit	Minimal x 1	v/c to reach for arm rest, does not use right side
Standing pivot	Minimal-moderate x 2	v/c to reach for arm rest and to slowly lower into chair, does not use right side, takes a few seconds to recover balance once standing before moving
Standing	Minimal-moderate x 2	Able to stand 1 min before needing a break, leans to left side, used left UE for assistance
Walking	Moderate x 2	Requires help with foot/hand progressions, not confident with steps, fatigues after 10'
Stairs	Unable to at this time	Not applicable

The patient's balance was tested through the Berg Balance Scale (which can be seen in Appendix B). The scale looks at 14 different activities that requires the patient to maintain their balance as well as limit compensatory movement. Each domain is scored 0-4 with 0 meaning the patient is unable to do it and 4 meaning they are able to without substitutions. The patient scored an 11 out of 56, indicating she has extremely severe balance deficits.

The Modified Ashworth is a well-accepted tool when assessing spasticity following CVA patients due to its simplicity and efficiency. Blackburn et al.[13] state the test has adequate intra-rater reliability with an agreement range from 57.5% to 85% percent and demonstrates poor interrater reliability with an agreement range of 42.5% to 50%. The authors conclude to say the

test is better if one rater is performing and documenting the scores. Katz et al.[14] discovered high convergent validity with a *r* coefficient of 0.94 agreement with the Fugl-Meyer Assessment (FMA), which is another commonly accepted tool for examining patients following stroke. An example of this assessment can be found in Appendix C. This almost perfect agreement allows one to appropriately use the Modified Ashworth to assess spasticity following a stroke. The Berg Balance Scale is intended to be used with older individuals and stroke patients. An improvement of 5 of more is considered clinically significant.[15] Hiengkaew et al[15] state excellent test-retest reliability with an Intraclass Correlation Coefficient (ICC) rating of 0.95. Berg et al[16] concluded the intra- and interrater reliability to be excellent with ICC scores of 0.98 and 0.97 respectively. They also shared a Cronbach alpha score of 0.97, meaning it holds very high internal consistency. Mao et al[17] compared the Berg Balance Scale to the Fugl-Meyer Assessment and state a concurrent validity score of r = 0.90-0.92, concluding that the test measures what it intends to measure. The methods of assessment were chosen due to their use as valid check-recheck tools to accurately determine patient progress.

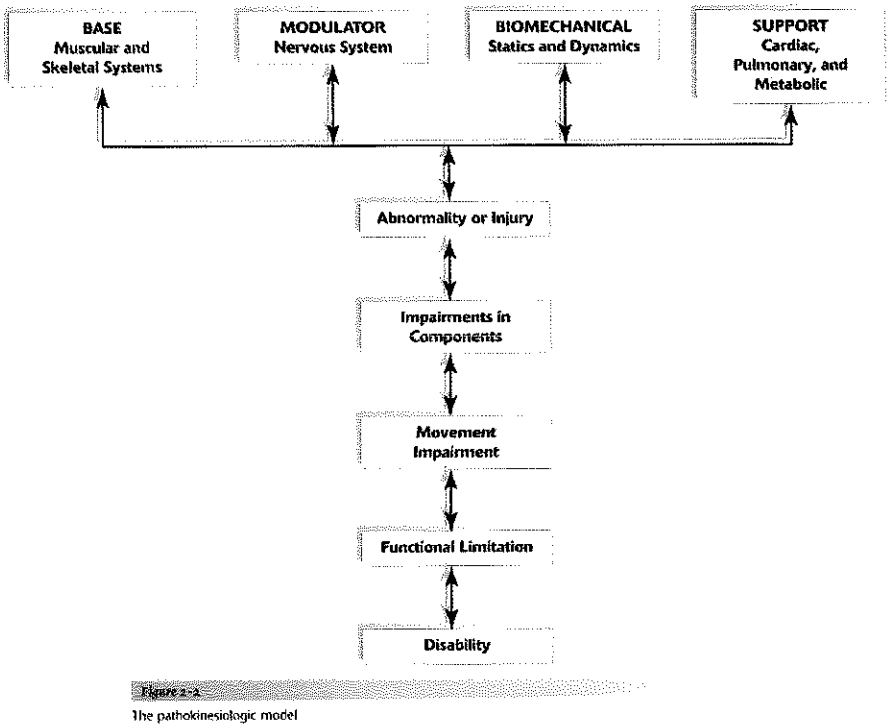
EVALUATION & DIAGNOSIS

The physical therapy examination revealed a significant impairment in mobility and function. Using the pathophysiologic model, a pathology, in this case a stroke, occurs which leads to impairments; thus, affecting the individual's function and participation in society. An example from this model can be seen below in figure 4.[18] Since a stroke occurs in the brain, the underlying cause to the impairments is neurological in nature. The patient's primary impairments were diminished neuromuscular control, reduced proprioception, altered sensation, and numbness. These have led to the development of secondary impairments of generalized

weakness, reduced ROM, impaired balance, and increased levels of fatigue. Table 2 gives a full list of the patient's problems in the order of relevance.

Table 2: List of Problem/Impairments

Problem /Impairment
1. Unable to verbally communicate
2. Decreased endurance
3. Impaired balance/proprioception
4. Spasticity on right
5. Generalized weakness on right
6. Global limitations in ROM on right



The pathokinesiologic model

Figure 4: Pathokinesiologic Model[18]

These impairments severely diminished the level at which the patient could perform ADLs. Due to her communication deficits, she was unable to properly interact with others and was unable to describe how she felt or what she needed. Her decreased endurance restricted her from being able to access the community efficiently which placed strain on her external support. The spasticity assisted in restricting her ROM which impeded her ability to use her right arm for self-care functions such as writing or toilet care. The weakness and diminished proprioception in the right lower extremity decreased her functional mobility and transfers, which forced her to use assistance whenever she wanted to move.

Using the Guide to Physical Therapy practice, the patient fits under Pattern 5D: Impaired Motor Function and Sensory Integrity Associated With Nonprogressive Disorders of the Central Nervous System—Acquired in Adolescence or Adulthood.[19] The ICD-10 code for this episode of care was I63.50 for cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebral artery.

IMPRESSION & PROGNOSIS

Rehabilitation potential for this client at evaluation was fair. She was not expected to regain a majority of her motor function. The severity of the stroke as well as the location are two main reasons why the prognosis was low. Another factor was the limited amount of functional recovery made in the seven months since her stroke when compared to her prior level of function. With these considerations in mind, minimal levels of function, such as standing transfers and short distance ambulation, were expected to be obtained. The clinical impression of the patient was that she would benefit from skilled physical therapy, especially from neuromuscular interventions. The patient was well within the window for recovery as progress can be seen past two years in some cases.[6] She was also working with a speech-language

pathologist as well as an occupational therapist, which allowed PT to focus on functional movements, transfers, and proprioceptive & musculoskeletal impairments. The short-term goals for the patient at the date of evaluation were for the patient to be educated on how to perform safe transfers as well as to educate the family on proper body mechanics and positioning when providing assistance. The second short term goal was to properly fit the patient for an assistive device and orthotics. The long-term goals for the patient were to be able to stand for three minutes with contact guard assist (CGA) to be able to perform basic ADLs, such as grabbing cups from a cupboard. The second long-term goal was for the patient to walk 20 feet with minimal assistance on right foot progressions with appropriate assistive device. Short-term goals were to be met in two weeks, and the long-term goals to be met in 12 weeks. Re-certification of treatment was to happen every 6 weeks to review the need for therapy. Along with this, progress was looked at every two weeks to determine the efficacy of the interventions and attempt to improve the plan of care. Goals were updated according to patient progression.

INTERVENTIONS

The patient was to present to outpatient PT twice a week with a starting duration of 12 weeks and was seen for 45-minute sessions. Due to the progress she made within the first 12 weeks, her plan of care was extended another 13 weeks. She was also working with OT and SLP but scheduled those sessions as to not interfere with PT. Her husband or sister accompanied her every session and were active participants. The entire episode of care was divided into three phases: weeks 0-10, weeks 11-20, and weeks 21-25.

During the first phase, treatment was structured around regaining strength, ROM, and low-level functions such as standing, walking in the parallel bars, and transfers. Strengthening was achieved in supine, performing bridges with a 3 second hold, hip abduction against a pillow,

hip adduction against a pillow, hip flexion, short arc quads, and heel slides, which all required minimal assistance. All exercises were performed on the patient's right lower extremity (LE) and were done at 15 repetitions with each. These exercises were added to the home exercise program (HEP). The family demonstrated compliance and performed each daily. PT also performed 15 reps of passive range of motion (PROM) to regain motion in shoulder flexion, shoulder abduction, elbow extension, and bringing knees to chest in supine. However, to engage the neuromuscular component, the patient was instructed to push back at end range, utilizing the contract-relax proprioceptive neuromuscular facilitation (PNF) concept. When tension in the golgi tendon organ increases, it fires a signal to the agonist muscle to relax, allowing that muscle to stretch further. The isometric contraction increases the tension on the tendon, thus leading to a larger signal.[20] These stretches were prescribed to her HEP and were to be done in conjunction with her strengthening exercises. The functional tasks during this time were side-to-side bed mobility, supine to sit, sit to supine, sit to stand, stand to sit, standing pivot transfer, and standing and walking in the parallel bars. She did require minimal to moderate assistance with each activity but progressed to a reduction in the level of help needed. The family was educated in the transfers and demonstrated them to ensure safety and proper mechanics. Around the 10-week mark, she exhibited control with these movements and progressed to more challenging tasks.

The second phase in her intervention focused on regaining higher levels of function. She continued to work with OT twice a week but discontinued with speech therapy as limited progress was made. Patient demonstrated improved strength in bilateral LE's but continued to have restrictions in gait, more specifically with fatigue and weight shifting. To combat this, the patient completed 15 repetitions with 3 second holds in standing marches and long arc quads in seated. Stabilizing reversals and dynamic reversals were done to the pelvis in a right to left,

posterior to anterior diagonal at the parallel bars to work on weight shifting to the left LE. Hand placements were at the anterior left hip and the right posterolateral buttock. The patient was instructed to perform a 5 second isometric contraction into each hand. This was progressed to stabilizing reversals where the only change was an isotonic contraction instead of isometric. This was done to mimic the diagonal weight shift in walking and was to promote balance and coordination. Parts-to-whole training was a good way in helping regain motor control with more complex tasks such as walking and seemed to benefit the patient. The patient progressed to walking outside the parallel bars with a hemi-walker. Gait training progressed to 40 feet before fatigue set in and was able to take 4-5 steps before requiring minimal to moderate assistance with right foot progressions. She did wear a 2" platform on the left foot to help with foot clearance, and a right ankle foot orthotic (AFO) to combat the inversion contracture, which has been treated with botulinum toxin type A (Botox) injections. Sun et al.[21] performed a meta-analysis on 27 randomized controlled trials and found that Botox injections improved muscle tone and increased Fugl-Meyer Assessment scores; however, effects tapered after 12 weeks. Trigger point release also gave short term benefits and was performed prior to gait training. She demonstrated control with sit to stands, stand to sits, pivot transfers, and bed mobility; however, she still had to be reminded not to push off with her arms while performing sit to stands. The patient was able to tolerate 3 minutes of standing at a closet with minimal assistance to maintain midline in standing. She was able to move cones around in the closet using her right hand to mimic getting something out of the cupboards. After talking with OT, her new long-term goals were to be able to walk 100'+ in the community with a four wheeled walker (FWW) with CGA, to be able to walk up 2 steps into her sister's house with minimal assist, and to be able to stand for 8 minutes with CGA.

The final phase (week 20 to week 25) of her intervention was to improve overall endurance and to progress to even more challenging tasks. She continued to make gains in OT and had been working with PT to define new goals. Patient began to ambulate up and down a set of 4 steps in the clinic. She started off requiring 2 x moderate assist to help with weight shifts, foot clearances, and lowering down to the next step. She progressed to walking up and down 4 steps twice without a break and required minimal assist for foot progressions coming down as her foot would get caught on the step. The family was educated in how to safely assist and properly demonstrated it in therapy. She progressed to a four-wheeled walker (FWW) and wears a 1" lift on her left foot. She still had a minor inversion contracture but was being controlled with botox and an AFO. Gait progressed to 80+ feet before fatiguing and no longer required help with right foot progressions. Standing was done in the parallel bars and was instructed to hit a balloon back and forth with the therapist, forcing her to use corrective strategies for balance. Standing could be tolerated for 8 minutes, but she required minimal assistance with maintaining midline as she fatigued. The patient was discharged after she met all her goals in therapy and was able to safely move around her home. OT discharged her earlier the same week and instructed the patient to contact therapy if there was major regression or any questions.

OUTCOMES

The patient had achieved all of the goals set at the beginning of therapy and more. She surpassed her initial expectations and demonstrated a strong will to make improvements. Strength improved to 3+/5, meaning she possessed the strength necessary to perform ADLs and functional mobility. ROM had improved to 10-15 degrees from full ROM with overhead arm movements, elbow extension, and hip flexion. Her spasticity reduced to a 1/4 on the Modified Ashworth, which means she still catches towards the last 15-20 degrees of the motion. Her

inversion contracture had become less evident but still required an AFO to maintain proper alignment. The functional assessment at discharge showed she made substantial improvements and can be seen below in Table 3. The Berg Balance Scale score improved to a 26 out of 56. A change of 5 points is needed to be 95% confident that true change has occurred if their initial score is within 0–24 on the Berg Balance Scale.[22] The patient and her caregivers adhered to the plan of care and executed the HEP as instructed. The patient worked diligently and didn't let her prognosis dictate her level of function and independence. She was deemed safe to return to home but should be cautious as she is still a fall risk. Feedback from the patient and her family was positive, and they expressed gratitude and satisfaction with the plan of care.

Table 3: Functional Assessment at Discharge

Task	**Assistance required**	**Other comments**
Supine-to-sit	Moderate independent	Can get stuck at times with push-off using right
Sit-to-stand	Contact guard x 1	v/c to not push off with unsteady surface and to use the chair
Stand-to-sit	Contact guard x 1	v/c to reach for arm rest
Standing pivot	Minimal x 1	Better balance once standing and is able to progress R LE on her own, v/c to reach for chair when sitting
Standing	Contact guard-minimal x 1	Able to stand 8'+ but requires some assist with maintaining midline at times
Walking	Contact guard-minimal x 1	Able to ambulate 100'+ in community, able to progress right foot independently until fatigued
Stairs	Contact guard-minimal x 1	Patient is able to go up stairs with contact guard and only requires assistance going down for right foot progressions as her leg gets caught on the step

CHAPTER III

DISCUSSION

The patient made substantial progress throughout therapy. At initial examination, the patient demonstrated multiple impairments and heavily relied on external support to perform ADLs. Fast forward 25 weeks, and the patient is fully independent with bed mobility, able to transfer safely with minimal assistance, able to ambulate in the community with a FWW using CGA, and is able to complete simple ADLs around her home. Physical therapy verified that improvements in function and performance may be seen in the sub-acute and chronic stages of a stroke. Physical therapy in combination with Botox injections proved to be an effective way to manage the patient's spasticity. Jang & Sung[23] concluded that Botox in conjunction with physical therapy can show effects lasting longer than 12 weeks in terms of reduced spasticity. This management can help form long term reductions in spasticity which may lead to more overall function for the patient. Gait training in high frequencies of 20 to 30 minutes a day for 3 to 5 days a week has shown to improve walking performance.[11] A meta-analysis by Peurala et al.[11] concluded that high frequency gait training develops better mobility, a higher gait speed, an increased endurance capacity as well as improvements in self-care.

Another aspect that played a crucial role during this plan of care was the education provided and compliance of the family. As stated previously, her husband and sister were very involved throughout therapy; therefore, their understanding and compliance with exercises and transfers was pivotal in progressing the patient. The education also helped ensure that the patient would be safely transferred outside the clinic. The family was also educated on the type of

muscle training that has been shown to be most effective for stroke patients. Eccentric muscle training in combination with task-oriented strength training have shown to be effective in treatment of chronic stroke patients. The simplicity of these exercises helps to promote compliance and adherence and also makes it easy to include in the patient's HEP.[24]

Feedback from the patient was gathered prior to each treatment session. The questions were directed towards her and her husband and helped to give an idea as to how things were going at home. The family would then communicate what has been working and what needs improving. This patient-centered approach helped to ensure the best quality of care and also address the immediate needs of the family. Feedback from the family also helped direct therapy interventions, because it would identify what is limiting the patient outside the clinic and how therapy could address that in the clinic. The patient had to be re-certified for therapy every 6 weeks, which is when her functional movements would be assessed and documented. Progress was assessed through the completion of tasks and what levels of assistance she required to complete that task. For example, if one week the patient was able to walk 40 feet using minimal assistance with right foot progressions, and the next week she can do the same distance with no assistance, that would be positive progress for the patient, because she is gaining more independence with her movements.

Even though the treatments were designed with evidence-based practice in mind, there are interventions that could not be done in the clinic that would have been advantageous. For future cases involving a stroke, it would be interesting to research the efficacy of virtual-reality (VR) training. This technology is relatively new (within the past five year) and could be a significant tool to facilitate recovery. O'Brien et al.[25] depict the usage of VR to be effective when improving gait, balance, and coordination; however, the limitation is that more research is

needed to confidently conclude its validity. Another area that should be investigated is for the management of spasticity. Botox and physical therapy together have shown to reduce spasticity with varying duration. Research should be done to see if there is a more cost-effective way to manage spasticity. For a 12-week period, a series of Botox injections can cost the patient around $200 depending on insurance.[26] This may become costly to the family if long-term Botox management is needed.

There were a few limitations of this case report. Her past medical history was not talked about often, so the nature of her stroke is unknown. The time it took for her to seek medical attention is unknown and would have affected the initial prognosis at examination. Missing the initial evaluation and subjective information also limited the study as the family's initial complaints are unknown by the writer. The most important limitation of the study is that the writer worked with the patient for a fraction of her total time in therapy. She worked in therapy for around 12 months, and the writer was with her for 1/6 of that time. Being able to see the patient throughout the entire episode of care is helpful, because it allows one to accurately track the progress of a patient as well as give an idea as to what is effective and ineffective. Lastly, the communication barrier was problematic and allowed space for miscommunications to occur. Even though feedback was obtained through her husband, there may have been pieces of information lost in translation that would have been useful to know.

Some things were found to be effective throughout the plan of care and other interventions were not effective. Great therapists learn from mistakes made and use the knowledge gained to improve for future situations. Reflecting on the initial evaluation, the therapist should have asked the patient more questions about her history to get a better idea of interests, prior levels of function, and mechanism of injury. Learning the exact location of the

stroke would give the therapist an idea as to what to expect for function and what areas therapy should focus on. A stroke specific quality of life scale should have been given to the patient at the initial evaluation to use as an objective re-check tool for progress. For an evaluation, a Fugl-Meyer Assessment (FMA) should have been chosen to give a valid, objective score regarding the patient's balance, gait, and transfers. This tool gives a number that can easily be used to assess clinical change and its significance. The FMA carries high inter- and intra-rater reliabilities with 79-100% agreements with any given score.[27]

For the plan of care, PNF techniques should have been implemented earlier. The parts-to-whole method of right foot progression was effective at 12 months post stroke, suggesting it would have been more effective if performed sooner in the plan of care. Aquatic therapy could have also been used earlier in the intervention to promote functional movement and to tolerate weightbearing positions at longer durations. Reducing the weight bearing load would have limited the fatigue aspect and allowed the patient to get more time in an upright position, which would have benefitted her proprioception.

As stated, evidence-based practice was kept in mind while designing the plan of care. Areas of further investigation would be on the efficacy of manual therapy when managing spasticity and contractures. The theory was that it would help the patient in the short-term to improve her functional capacity in the clinic. It would be interesting to see if the 10 minutes spent performing trigger point release on her calf was a good use of therapy time or not. Because it was not a neurology clinic, spasticity was not a common impairment, meaning the most recent literature may not have been used for treatment.

There would not have been any additional referrals for this individual. The patient worked with a neurologist, OT, SLP, PT, and a social worker. She was referred to her doctor

when the family had serious questions that PT could not give an answer to. OT and SLP worked closely with PT in developing goals and treatment plans that complimented one another. For instance, PT worked with OT in prescribing a FWW, because the patient had to have proper hand control to work the brakes on the walker as well as the functional capacity to walk.

Although there were changes that could have been made to better improve outcomes, the patient's case was handled properly, and the outcomes reflected that. The patient reached a functional level that was satisfactory to the patient and the family, meeting and surpassing all the goals stated prior to care. This regaining in function helped increase the patient's safety when performing ADLs and gave the patient a sense of independence once again.

APPENDIX

Appendix A

Modified Ashworth Scale

Grade	Description
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch or by minimal resistance at the end of the range of motion (ROM) when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension
9	Unable to test

Appendix B

Name: _____ Date: _____

Rater: _____

BERG BALANCE SCALE
14-Item Long Form Original Version

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 chair(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 feet together
(0) needs help to attain position and unable to hold for 15 seconds

( ) TOTAL SCORE (Maximum = 56) ,a person scoring below 45 is considered to be at risk for falling.

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 FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up 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 >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

Appendix C

FMA-UE PROTOCOL — Rehabilitation Medicine, University of Gothenburg

FUGL-MEYER ASSESSMENT
UPPER EXTREMITY (FMA-UE)
Assessment of sensorimotor function

ID:
Date:
Examiner:

Fugl-Meyer AR, Jaasko L, Leyman I, Olsson S, Steglind S: The post-stroke hemiplegic patient. A method for evaluation of physical performance. Scand J Rehabil Med 1975, 7:13-31.

A. UPPER EXTREMITY, sitting position					
I. Reflex activity				**none**	**can be elicited**
Flexors: biceps and finger flexors (at least one) **Extensors**: triceps				0 0	2 2
			Subtotal I (max 4)		
II. Volitional movement within synergies, without gravitational help				**none**	**partial**	**full**
Flexor synergy: Hand from contralateral knee to ipsilateral ear. From extensor synergy (shoulder adduction/ internal rotation, elbow extension, forearm pronation) to flexor synergy (shoulder abduction/ external rotation, elbow flexion, forearm supination). **Extensor synergy:** Hand from ipsilateral ear to the contralateral knee	Shoulder	retraction		0	1	2
		elevation		0	1	2
		abduction (90°)		0	1	2
		external rotation		0	1	2
	Elbow	flexion		0	1	2
	Forearm	supination		0	1	2
	Shoulder	adduction/internal rotation		0	1	2
	Elbow	extension		0	1	2
	Forearm	pronation		0	1	2
			Subtotal II (max 18)			
III. Volitional movement mixing synergies, without compensation				**none**	**partial**	**full**
Hand to lumbar spine hand on lap	cannot perform or hand in front of ant-sup iliac spine hand behind ant-sup iliac spine (without compensation) hand to lumbar spine (without compensation)			0	1	2
Shoulder flexion 0°- 90° elbow at 0° pronation-supination 0°	immediate abduction or elbow flexion abduction or elbow flexion during movement flexion 90°, no shoulder abduction or elbow flexion			0	1	2
Pronation-supination elbow at 90° shoulder at 0°	no pronation/supination, starting position impossible limited pronation/supination, maintains starting position full pronation/supination, maintains starting position			0	1	2
			Subtotal III (max 6)			
IV. Volitional movement with little or no synergy				**none**	**partial**	**full**
Shoulder abduction 0 - 90° elbow at 0° forearm pronated	immediate supination or elbow flexion supination or elbow flexion during movement abduction 90°, maintains extension and pronation			0	1	2
Shoulder flexion 90° - 180° elbow at 0° pronation-supination 0°	immediate abduction or elbow flexion abduction or elbow flexion during movement flexion 180°, no shoulder abduction or elbow flexion			0	1	2
Pronation/supination elbow at 0° shoulder at 30°- 90° flexion	no pronation/supination, starting position impossible limited pronation/supination, maintains start position full pronation/supination, maintains starting position			0	1	2
			Subtotal IV (max 6)			
V. Normal reflex activity assessed only if full score of 6 points is achieved in part IV; compare with the unaffected side				**0 (IV), hyper**	**lively**	**normal**
biceps, triceps, finger flexors	2 of 3 reflexes markedly hyperactive or 0 points in part IV 1 reflex markedly hyperactive or at least 2 reflexes lively maximum of 1 reftex lively, none hyperactive			0	1	2
			Subtotal V (max 2)			
			Total A (max 36)			

B. WRIST support may be provided at the elbow to take or hold the starting position, no support at wrist, check the passive range of motion prior testing		none	partial	full
Stability at 15° dorsiflexion elbow at 90°, forearm pronated shoulder at 0°	less than 15° active dorsiflexion dorsiflexion 15°, no resistance tolerated maintains dorsiflexion against resistance	0	1	2
Repeated dorsifexion / volar flexion elbow at 90°, forearm pronated shoulder at 0°, slight finger flexion	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Stability at 15° dorsiflexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	less than 15° active dorsiflexion dorsiflexion 15°, no resistance tolerated maintains dorsiflexion against resistance	0	1	2
Repeated dorsifexion / volar flexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Circumduction elbow at 90°, forearm pronated shoulder at 0°	cannot perform volitionally jerky movement or incomplete complete and smooth circumduction	0	1	2
	Total B (max 10)			

C. HAND support may be provided at the elbow to keep 90° flexion, no support at the wrist, compare with unaffected hand, the objects are interposed, active grasp		none	partial	full
Mass flexion from full active or passive extension		0	1	2
Mass extension from full active or passive flexion		0	1	2
GRASP				
a. Hook grasp flexion in PIP and DIP (digits II-V), extension in MCP II-V	cannot be performed can hold position but weak maintains position against resistance	0	1	2
b. Thumb adduction 1-st CMC, MCP, IP at 0°, scrap of paper between thumb and 2-nd MCP joint	cannot be performed can hold paper but not against tug can hold paper against a tug	0	1	2
c. Pincer grasp, opposition pulpa of the thumb against the pulpa of 2-nd finger, pencil, tug upward	cannot be performed can hold pencil but not against tug can hold pencil against a tug	0	1	2
d. Cylinder grasp cylinder shaped object (small can) tug upward, opposition of thumb and fingers	cannot be performed can hold cylinder but not against tug can hold cylinder against a tug	0	1	2
e. Spherical grasp fingers in abduction/flexion, thumb opposed, tennis ball, tug away	cannot be performed can hold ball but not against tug can hold ball against a tug	0	1	2
	Total C (max 14)			

D. COORDINATION/SPEED, sitting, after one trial with both arms, eyes closed, tip of the index finger from knee to nose, 5 times as fast as possible		marked	slight	none
Tremor	at least 1 completed movement	0	1	2
Dysmetria at least 1 completed movement	pronounced or unsystematic slight and systematic no dysmetria	0	1	2
		≥ 6s	**2 - 5s**	**< 2s**
Time start and end with the hand on the knee	at least 6 seconds slower than unaffected side 2-5 seconds slower than unaffected side less than 2 seconds difference	0	1	2
	Total D (max 6)			

		TOTAL A-D (max 66)		
H. SENSATION, upper extremity eyes closed, compared with the unaffected side		**anesthesia**	**hypoesthesia or dysesthesia**	**normal**
Light touch	upper arm, forearm palmary surface of the hand	0 0	1 1	2 2
		less than 3/4 correct or absence	**3/4 correct or considerable difference**	**correct 100%, little or no difference**
Position small alterations in the position	shoulder elbow wrist thumb (IP-joint)	0 0 0 0	1 1 1 1	2 2 2 2
			Total H (max12)	

J. PASSIVE JOINT MOTION, upper extremity, sitting position, compare with the unaffected side				**J. JOINT PAIN** during passive motion, upper extremity		
	only few degrees (less than 10° in shoulder)	decreased	normal	pronounced pain during movement or very marked pain at the end of the movement	some pain	no pain
Shoulder						
Flexion (0° - 180°)	0	1	2	0	1	2
Abduction (0°-90°)	0	1	2	0	1	2
External rotation	0	1	2	0	1	2
Internal rotation	0	1	2	0	1	2
Elbow						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Forearm						
Pronation	0	1	2	0	1	2
Supination	0	1	2	0	1	2
Wrist						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Fingers						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Total (max 24)				**Total** (max 24)		

A. UPPER EXTREMITY	/36
B. WRIST	/10
C. HAND	/14
D. COORDINATION / SPEED	/ 6
TOTAL A-D (motor function)	/66

H. SENSATION	/12
J. PASSIVE JOINT MOTION	/24
J. JOINT PAIN	/24

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