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Left Medullary Stroke and the Effects of Physical Therapy in the Acute Rehabilitation Setting: A Case study

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LEFT MEDULLARY STROKE AND THE EFFECTS OF PHYSICAL THERAPY IN THE ACUTE REHABILITATION SETTING: A CASE STUDY

by

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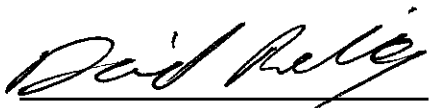

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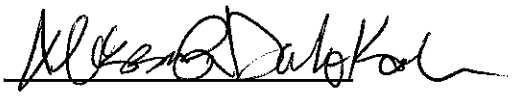
Signature 

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ABSTRACT

Background and Purpose. Approximately 800,000 strokes occur each year in the United States, either resulting in death or mild to moderate functional deficits. This case study examines the effectiveness of physical therapy treatment of a patient following a left medullary stroke in the acute rehabilitation setting.

Case Description. The patient was a 72-year-old male with a complex medical history who presented to the acute rehabilitation unit with right-sided weakness, diminished postural control, impaired muscle tone, and paresthesia. His admission was complicated by the onset of delirium during the second week of treatment.

Intervention. Physical therapy treatment provided to the patient addressed his functional impairments and activity limitations. Documented interventions included the following: right body range of motion, neuro re-education, functional electrical stimulation, bed mobility training, transfer training, right upper extremity protection & preventative care, therapeutic exercise, and patient education.

Outcomes. Following physical therapy intervention, the patient improved in right body and trunk motor control and increased his independence with bed mobility and transfers. However, due to his slow progress the patient was discharged prior to meeting all set goals.

Discussion. Despite slow progress, the patient responded favorably to treatment. More research needs to be done on the effects of delirium on stroke rehabilitation prognosis and interventions that promote optimal motor function recovery.

CHAPTER I

BACKGROUND AND PURPOSE

In the United States approximately 800,000 strokes occur each year resulting in either death or mild to moderate functional deficits.[1] Between 2003 and 2013, the number of stroke deaths per year decreased by 18.2%.[1] This decline can be linked to medical technology advancements and improved cardiovascular risk factor control interventions. This increase in stroke survival has resulted in post-stroke recovery becoming a more dynamic, multifactorial process that ultimately has aimed to improve functional outcomes in patients. When executing rehabilitation strategies, it is important to comprehend the variety of factors that can influence a patient's stroke recovery outcome including socio-demographic factors, initial injury, comorbidities, post-stroke depression, and genetic factors.[2] By understanding and applying the factors influencing stroke recovery outcomes, clinicians can provide improved patient education regarding stroke prognosis and rehabilitation timeline.[2]

A stroke can be defined as a sudden interruption of blood supply to regions of the brain. This blockage can either be classified as ischemic or hemorrhagic. Ischemic strokes account for the majority of cerebrovascular accidents (CVA) and result from an abrupt blockage within a cerebral artery, whereas hemorrhagic strokes occur following the bursting of a blood vessel. The effects of this condition are dictated based on the location of the stroke and how severely it occurs.[3]Although strokes occur in many different populations, predisposing factors can exist, placing certain individuals at an increased risk for injury. These include diabetes, high blood

pressure, smoking, hyperlipidemia, family history, irregular heartbeat, and a narrowing of arteries.[4]

The current case outlines a patient's rehabilitation process in an acute medical setting following an acute linear infarct within the left paramedian medulla due to small vessel disease. Medial medullary syndrome results from blockage to the anterior spinal artery, a branch of the vertebral artery (see Figure 1). Also known as Dejerine Triad, patients will typically present with the following impairments: upper and lower body weakness, loss of vibration and proprioception contralateral to the lesion, and ipsilateral hypoglossal paralysis.[5] Other common impairments may include vertigo, dizziness, diminished kinesthetic awareness, limb ataxia, dysarthria, dysphagia, and nystagmus.[6]

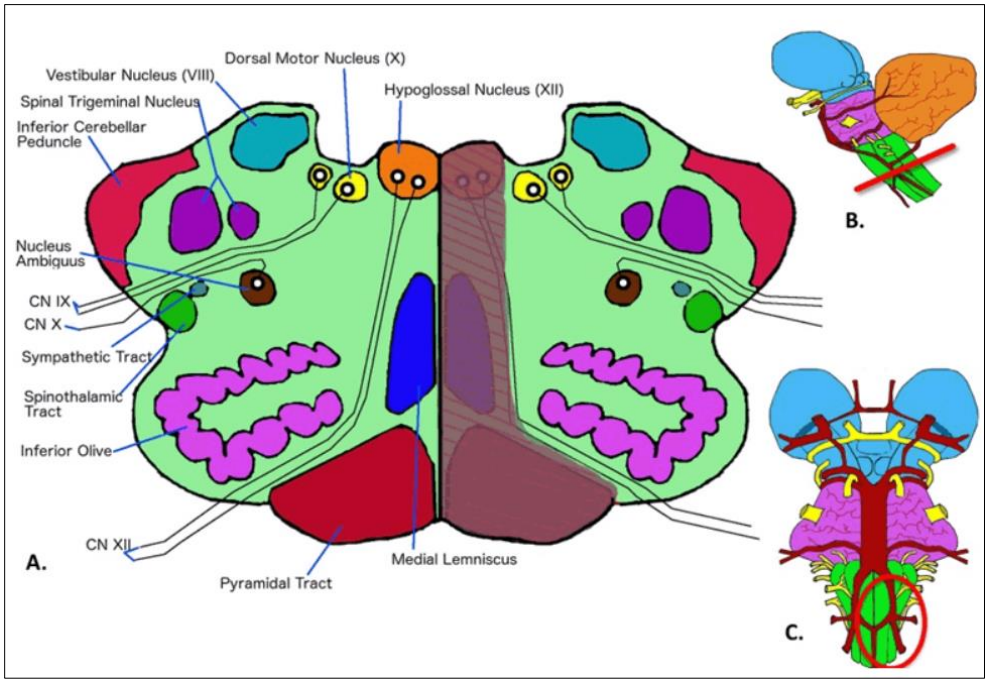

Figure 1. Structures affected in medial medullary syndrome.[5] (A) Cross-sectional view of nuclei affected during medial medullary syndrome. (B) Lateral view of the brainstem with the red line indicating the level of the cross-section in image A. (C) Ventral view of the brainstem level affected by medial medullary syndrome. The red circle highlights the anterior spinal artery.
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Regardless of the type or location of stroke, medical attention needs to be sought immediately to prevent further damage to brain tissue and promote recovery of function. Initial stroke intervention typically includes a physical exam, blood tests, and imaging such as CT, MRI, carotid ultrasound, angiogram, or echocardiogram[7]. Patients admitted within four and a half hours of symptom onset may be a candidate to receive a thrombolytic drug known as tissue plasminogen activator (tPA), which is the gold standard for stroke treatment and acts quickly to breakdown clots and restore blood flow to the brain. The intravenous tPA can significantly reduce a patient's long-term disability and risk of complication.[7-8] Several studies identified patients who had received treatment with intravenous thrombolysis following ischemic stroke displayed improved long-term survival and functional recovery.[9-10] Additional medical and surgical procedures may be necessary interventions to prevent further bleeding and protect brain tissue.[7]

Following emergency intervention, patients who had survived a stroke were most likely referred to a rehabilitation center where they received continued monitoring and rigorous therapy. In an acute rehabilitation setting the interdisciplinary team will often consist of a physician (MD), nurse (RN), dietician (RD), physical therapist (PT), occupational therapist (OT), recreational therapist (RT), speech pathologist (SLP), social worker, psychiatrist, chaplain, and any other health professional involvement that is pertinent to the patient.[7] It is important for the health care team to develop a rehabilitation plan that is individualized and effective for the patient so that they are able to safely regain function and independence.

Rehabilitation services provided by a PT following a stroke may include a variety of interventions. Primary treatment interventions emphasized in acute rehabilitation include range of motion exercise, neuro re-education, electrical stimulation, transfer training, hemiparetic limb

care, fall-prevention education, assistive device fitting, balance training, activities of daily living (ADLs) training and functional task training.[11] These interventions aim to help the brain reorganize itself by forming new neural connections following an injury, a concept defined as neuroplasticity. Furthermore, in an acute rehabilitation setting it is important to understand the following principles of neuroplasticity: 1) use it or lose it, 2) use it and improve it, 3) intensity matters, 4) time matters, 5) salience matters (training must be meaningful to person), 6) age matters, 7) transference (improved learning of similar skills), 8) specificity, 9) repetition matters, and 10) interference (learned habits may negatively impact acquisition of similar tasks).[12] Failure to incorporate these principles into a patient's rehabilitation can lead to a loss of abilities or decreased functional recovery.

Understanding the previous principles is valuable due to the unique one to three month window of increased plasticity, or ability for neurons to adapt and form new connections, following an ischemic stroke.[13] This will guide therapeutic interventions and optimize patient motor recovery.

There are several different factors that can affect a patient's post-stroke recovery and long-term prognosis. Alawieh et al[14] outlined specific sociodemographic (age, gender, race, socioeconomic status), clinical (stroke subtype, initial injury, presence of comorbidities, post-stroke depression, rehabilitation therapeutics), and genetic factors that can impact stroke rehabilitation. An interdisciplinary health care team's understanding of the modifiable and non-modifiable factors that impact stroke recovery is vital when developing an individualized rehabilitation plan for patients in order to establish realistic functional goals and promote a patient's return to their prior level of function. Modifiable risk factors are ones that can be changed such as, high blood pressure, smoking, physical inactivity, diet, high blood cholesterol,

and being overweight. Risk factors that are non-modifiable may include age, gender, socioeconomic status, ethnicity, and family history.

Another factor that can negatively affect post-stroke recovery is the presence of delirium. Delirium is a rapidly changing, serious disturbance in a patient's mental abilities that results in confusion and reduced awareness of the surrounding environment.[15] Although delirium can affect all age groups, it is typically encountered in elderly populations. Delirium can last anywhere from a few hours to several weeks or months if the condition is not addressed.[15] Changes in metabolic balance, medication, infection, surgery, or chronic illness can lead to delirium. The presence of delirium can often limit therapy intervention and patient participation, due to patient safety concerns, if not addressed by the interdisciplinary team.[16-17]In order to limit the possibility of detrimental short-term and long-term effects, it is important that the health care team acts quickly. Treatment during this time can include family education, patient monitoring, pharmacological management, and non-pharmacological management.[18-19] PTs can play a vital role in non-pharmacological management of delirium by providing support and orientation for the patient, providing the patient with an unambiguous environment, educating staff, and helping maintain patient competence. Interventions such as early mobilization, creating a neutral environment, establishing day-time schedule, and encouraging participation in rehab therapy can play an integral role in the patient returning to their previous functional status.[18]

This case study will focus on the acute rehabilitation management of a patient following a left medullary stroke. The aim of the case study is to discuss and evaluate the role of physical therapy in stroke recovery. This will demonstrate how rehabilitative services can impact a patient's strength, motor control, and functional mobility.

CHAPTER II

CASE DESCRIPTION

The patient was a 72-year-old right hand dominant male with a past medical history (PMH) including, but not limited to the following: diabetes mellitus II, hypertension, morbid obesity (BMI 45.8), osteoarthritis s/p bilateral TKAs, mantle cell lymphoma, obstructive sleep apnea on Continuous Positive Airway Pressure (CPAP), and peripheral vascular disease s/p bilateral iliac artery stents.

The patient was initially admitted to the emergency room with vertigo and right sided weakness lasting for several hours. The patient did not receive tPA as he was outside the treatment window making him an ineligible candidate for intravenous thrombolysis treatment. Magnetic Resonance Imaging (MRI) demonstrated an acute infarct within the left paramedian medulla. CT of head and neck identified moderate stenosis of the left Inferior Cerebellar artery (ICA), mild to moderate stenosis of left Posterior Cerebral Artery (PCA) and basilar artery, and a two millimeter vascular infundibulum or left posterior communicating aneurysm. The patient continued to take Aspirin and Brillanta. A gastro-jejunal (GJ) tube was placed two days following admission due to patient's dysphasia. His hospital course was complicated by a fall without injury while transferring from bed to a commode, development of hypoxia due to antibiotics, acute kidney injury, and hypernatremia presenting as dehydration and diuresis. The patient received formal treatment from PT, OT, SLP, all of whom recommended continued therapy upon discharge to inpatient rehabilitation program.

The patient was admitted to the acute rehab unit 13 days following his stroke. He denied chest pain and shortness of breath, but was significantly dysarthric and difficult to understand. He related no issues with bowel or bladder, no pain at the GJ tube site, and no hearing or vision changes.

Examination, Evaluation and Diagnosis

The initial physical therapy evaluation took place bedside with difficulty understanding the patient due to dysarthria. The patient's wife was present during the examination and assisted with subjective information. The patient was a retired contractor and enjoyed spending time outdoors with his family. They lived in an apartment with the patient having used walking sticks within the home and a powered cart for community mobility at the grocery store. His wife reported the patient having had three falls within the last six months (two at home, one at the hospital). Prior to hospitalization the patient was independent with self-care and ADLs. Based on the occupational therapy evaluation, the patient displayed dependence with all self-care and ADLs.

The patient was alert and oriented to person, place, time and situation, and able to follow single-step commands 100% of the time. Memory was not formally assessed, but mild impairment suspected. Following the subjective portion of the examination, the patient was deemed a candidate to receive physical therapy due to his stable vitals and his ability to follow verbal commands with visual cueing.

The examination was based on the neurologic exam detailed by Kegelmeyer et al[20]. The examination consisted of an integumentary assessment, palpation of the right UE, passive and active range of motion (ROM), resisted isometric movement (RIMs), sensation testing, seated posture and balance assessment, muscle tone assessment, and completion of a functional

outcome assessment. Cranial nerve screening was completed by the referring physician the day prior, therefore, cranial nerves were not assessed by physical therapy. The physician reported all cranial nerves as being normal with exception of the patient's left hypoglossal nerve as demonstrated by a leftward deviation with tongue protrusion.

The patient presented with no edema or integumentary deficits. Upon palpation the patient reported pain at the right coracoid process and right proximal biceps tendon. Passive range of motion (PROM) was within functional limits for bilateral upper extremities (UE) and lower extremities (LE). The patient's active range of motion (AROM) was unable to be assessed on the right UE and LE due to his decreased strength and impaired muscle tone. The patient's AROM on the involved UE and LE was within functional limits. Strength was tested grossly with resisted isometrics and results are presented in Table 1.

Table 1. Initial Gross Strength screen

	Right	**Left**
Upper extremity	0/5	4+/5
Lower extremity	0/5	4+/5
Trunk	1/5	

The patient reported right UE and LE paresthesia, however light touch sensation was intact on bilateral UEs. Patient had mild impairment to light touch sensation on bilateral feet suspected due to diabetic neuropathy. The patient had impaired deep sensation (vibration), impaired temperature discrimination, and impaired proprioceptive and kinesthetic awareness on the right UE and right LE.

Formal coordination testing was not able to be performed due to patient's right UE flaccidity and LE hypotonicity. The patient sat edge of bed (EOB) with a posterior lean. He attempted to sit up and right himself; however, he required max assist for sitting EOB. The patient was unable to stand independently or with assistance. The PT recommended the use of the overhead mechanical Liko lift with assist of two for transfers to ensure patient and staff safety. During the initial evaluation, the PT was unable to assess dynamic sitting or standing balance due to the patient's presentation. The patient's muscle tone was assessed based on the passive soft tissue stretching technique described when using the Modified Ashworth Scale (MAS).[21] Elbow flexion, combined hip and knee flexion, and ankle dorsiflexion were assessed bilaterally in the supine position to assess tone in the biceps brachii, quadriceps and gastrocnemius respectively. The patient's right upper extremity presented with flaccid tone with an absence of resistance to movement and the patient's right lower extremity presented as hypotonic with a diminished resistance to movement. The patient did not present with any catching or rigidity in the right UE or LE. Muscle tone was normal (MAS 0/4) in the left UE and LE.

The Postural Assessment Scale for Stroke (PASS) was performed and the patient scored a 3/36. The PASS is a 12-item performance-based scale used for assessing and monitoring postural control following stroke (see Appendix A).[22] Each item is scored from zero to three based on the level of assistance needed to complete the task. Larger scores indicate greater functional ability and independence with tasks. The PASS assessed both the patient's ability to maintain stable postures and maintain equilibrium changes during positional changes. The PASS is utilized within the first three months post-stroke and can be utilized to predict a patient's ability to assess and reintegrate into the community upon discharge.[22] Regarding patient ambulation at discharge,

Huang et al[23] reported patients with a total PASS score greater than 12.5/36 upon admission were likely to be ambulatory upon discharge. Therefore, patients with a PASS score less than 12.5 were likely to need and manual or power wheelchair upon discharge. Because the patient was unable to stand or perform independent seated balance he was not a candidate for other functional assessments such as the Berg Balance Scale, Romberg Test or the Dynamic Gait Index.

In addition to the PASS, the patient's functional abilities were assessed by physical therapy, occupational therapy, and speech language pathology, using the Self-Care and Mobility Section GG Items. The patient's dependence level with all self-care, transfers, and mobility tasks were assessed on a scale from one to six and documented in the electronic medical record. These items helped the therapy team assess admission performance and discharge goals. All GG items were assessed again upon discharge from acute rehabilitation unit.

Based on the examination findings, the patient's impairments and activity limitations were placed into the International Classification of Functioning, Disability, and Health (ICF) model (see Appendix B). This model guided the therapy team while developing the patient's plan of care, incorporating the dynamic interaction between his health condition, environmental factors, and personal factors.

The initial evaluation data indicated that the patient presented with force production deficits following medullary CVA and resulted in an increased level of assistance with bed mobility, transfers, gait, ADLs. According to Scheets et al[24], force production deficit is the most appropriate diagnosis because of his right-sided weakness, diminished postural control, impaired muscle tone and paresthesia. A differential diagnosis of movement pattern coordination deficit may also be appropriate; however, because of the patient's muscle tone presentation and postural

deficits, this diagnosis was ruled out. A diagnosis of hypokinesia was also ruled out due to lack of rigidity with passive ROM and inability to move against gravity on the right side.

Prognosis and Plan of Care

The estimated stay for the patient was four weeks. The therapy team predicted that the patient would be wheelchair-based upon discharge to a Transitional Care Unit (TCU). Patient goals included improved right body and trunk strength, independence with bed mobility, transfers and locomotion, attendance of stroke education and fall education therapy session, and a 25% improvement in PASS score compared to admission assessment. The goals mentioned above would help the patient gain independence and increased level of function.

The patient and his wife agreed to these goals and agreed to comply with interdisciplinary team's recommendations for the expected length of stay and discharge plan to TCU. Due to the fact that stroke recovery is a dynamic, multifactorial process with several contributing factors it is difficult to predict long-term outcomes. However, based on the patient's age, severity of initial injury, extensive list of comorbidities, the interdisciplinary team predicted that within one year, even though he may not return to his prior level of function, he would have improved function and independence with mobility, locomotion, and ADLs.

The patient was deemed appropriate for an intervention program after examination and evaluation. The patient received physical therapy, occupational therapy, and speech language pathology services while in acute rehab. Planned physical therapy interventions included bed mobility training, balance training, gait training, motor coordination training, group therapy, neuromuscular re-education, transfer training, fine motor coordination training, wheelchair management propulsion training, and progressive exercise. Interdisciplinary collaboration

continued to ensure all the patient's needs were being met and to promote functional recovery and achievement of established goals.

CHAPTER III

INTERVENTION

The patient was seen daily for 180 minutes of combined physical therapy, occupational therapy, and speech language pathology based on a setting-specific demand. Therefore, he received an average of 60 minutes of physical therapy each day with goals to address structural and functional impairments and activity limitations.

The first week of interventions included neuro re-education sitting EOB with a mirror to facilitate midline trunk management, bed mobility training, supine left LE strengthening, and supine PROM to the right UE and LE. It is shown that early PROM within the first three months following an ischemic stroke can lead to significant improvement in long-term motor function.[25-26] To promote increased trunk engagement, the patient was encouraged to sit upright in his wheelchair throughout the day, as tolerated.

At the end of the first week, significant changes occurred in the patient's disposition. During therapy sessions the patient alternated between bouts of restlessness and calm, his speech became more incoherent (only 15% of words intelligible), he had increased difficulty following commands and he was experiencing hallucinations two to three times per session, reaching out for unseen objects. Because of the patient's state of delirium, therapy intervention was limited and a set therapy schedule with a focus on daytime mobility was established. The patient was previously sleeping intermittently throughout the day and experiencing restlessness at night, so a daytime schedule aimed to promote alertness and improved sleep quality.[27] During the middle of the second week of treatment, the patient appeared increasingly lucid and his speech was more

discernable.

Treatment during the second week included neuro re-education for seated trunk control and right body weight acceptance, co-treatment session with speech language pathology to encourage upright position with feeding, Neuromuscular Electrical Stimulation (NMES) to the right shoulder and Xcite Functional Electrical Stimulation (FES) unit utilization for activity-based therapy in the right LE (see Table 2 for list of specific exercises). In a 2017 study, Eraifej et al[28] showed that functional electrical stimulation after a stroke results in improved motor function and improvement of ADLs. Following FES intervention the patient began to demonstrate initiation of active right LE motion.

Table 2. Right lower extremity exercises with Xcite FES.

Exercises
• Seated heel slides with skateboard • Seated ankle pumps • Seated hip extension by pressing heel into foam pad

The patient's wheelchair was fitted for a right arm tray and gel pillow to ensure safety and stabilization of his right UE. He was also fitted for a right-hand edema glove and referred to the Orthotics and Prosthetics department for fitting of a right Sully brace for stability management. Due to the patient's poor right UE motor control, it was important to encourage proper protection and greater stability of the hemiplegic shoulder, preventing the possibility for development of secondary shoulder pathologies.[29]

The third week of treatment focused on functional transfer training with a sliding board and assist of two, right LE strengthening and range of motion, progression of neuro re-education trunk strengthening tasks while sitting edge of mat with a demand for fine motor control, trunk over pelvis weight shifting and elongation and shortening in various planes of reaching. The patient responded well to repetition and specific interventions that were targeted at his impairments.

Additionally, a large aspect of treatment was patient and family education. Education was provided regarding the role of each rehab therapist, rationale for specific interventions, importance of protection of the right UE, and discharge setting recommendations. The patient attended two group therapy sessions focused on fall prevention education and stroke education. A systematic review reported that falls prevention programs that were focused on patient education were found to be effective in reducing fall rates among hospital inpatients and post-discharge populations.[30] The patient's wife was present during most interventions which was helpful for ensuring that educational instructions would be understood and carried out. Both his wife and son were instructed on application of Sully brace and NMES on right shoulder to be continued following discharge.

Wheelchair propulsion training and gait train had been predicted physical therapy interventions. However, these were not executed due to concern for patient safety. The patient was discharged to a transitional care facility (TCU) 20 days after admission to acute rehabilitation unit. Overall, the patient had slow progress and recommendations for continued therapy included right LE strengthening, functional transfer training with sliding board, bilateral LE weight bearing, and seated or standing controlled mobility tasks.

CHAPTER IV

OUTCOMES

Due to a variety of negatively contributing factors and overall slow progress, the patient was discharged to TCU after twenty days in the acute rehabilitation setting prior to meeting all therapy goals. This decision was made based on a collaborative effort from the interprofessional health care team including the patient and his family members. Objective and subjective outcome measures were used to judge the effectiveness of physical therapy. These measures included the patient's level of participation in therapy session, PASS score, patient's pain level, gross strength assessment, level of assistance with transfers, and input from family regarding education.

During his admission to the acute rehabilitation unit the patient progressed to be able to fully participate in therapy despite initial communication difficulties due to his dysarthria and delirium. At discharge, the patient was able alert and oriented, knew staff by name, used his call light to communicate with nursing staff to help him get up for therapy. The patient's PASS score improved from 3/36 to 4/36. As previously discussed, an initial score less than 12/36 is predictive of a patient to be non-ambulatory upon discharge.[23] This is consistent with this patient's case as he was wheelchair based at discharge from acute rehab. The patient initially reported pain of right shoulder girdle. Preventative and protective interventions were deemed effective due to the patient's subjective report of decreased right shoulder pain since admission; however, the patient's pain was not assessed quantitatively. The patient's strength was assessed grossly upon admission and prior to discharge. The results of the strength screen

at discharge is depicted in Table 3. No motor control function was gained in the right UE since admission. However, at discharge the patient was able to manage the limb with his left UE and he responded well to interventions targeted at protection of the right UE.

Table 3. Gross Strength Screen at Discharge

	Right	**Left**
Upper extremity	0/5	4+/5
Lower extremity	2-/5	4+/5

Upon admission the patient was dependent with all ADLs, mobility, and locomotion tasks. Transfer assistance was documented regularly for bed mobility, wheelchair mobility, and bed to mat transfers. A mechanical lift with assist of two was used by nursing staff during the entirety of his stay per therapy team recommendations for patient and staff safety during transfers. Based on patient performance in physical therapy sessions, the patient's assistance required with transfers as documented at admission and discharge is demonstrated in Table 4. The patient was unable to stand or attempt sit-to-stand transfers at discharge due to right-sided weakness and impaired upright postural control.

The patient's family received appropriate education regarding continued use of Sully brace and NMES for right shoulder preventative care. The patient's spouse and son were instructed in set-up for both interventions and provided with written instructions for more detailed explanation, ensuring that they would be able to share the information with TCU staff if necessary. The family was also educated on potential discharge settings and the health care team's rationale for TCU recommendation. The family expressed their understanding regarding

all education topics and were able to demonstrate competency in executing tasks to the therapy team. The patient and family were provided with appropriate contact information and instruction if they had future questions regarding education material discussed during acute rehabilitation stay.

Table 4. Documented Level of Assist with Mobility & Locomotion Tasks

	Admission	**Discharge**
Supine to Side lying Right	Moderate assist of two	Minimum assist of one
Supine to Side lying Left	Maximum Assist of two	Moderate assist of one and minimum assist of one
Supine to Sit	Mechanical lift with assist of two	Moderate assist of two
Sit to Supine	Mechanical lift with assist of two	Maximum assist of one and moderate assist of one
Sitting EOB	Maximum assist of one and contact guard assist of one	Stand by assist/Contact guard assist of one
Bed to Wheelchair	Mechanical lift with assist of two	Slide board transfer with maximum assist of one and moderate assist of one
Wheelchair Mobility	Dependent	Dependent

The acute rehabilitation goals met included improved right LE and trunk strength, increased independence with bed mobility and transfers, attendance of stroke education, and fall education therapy session. Goals that were not met included improved right UE strength, increased independence with locomotion, 25% improvement in PASS score compared to admission assessment. There were several factors contributing to the patient's slow progress following his stroke. These factors include, but are not limited to, the following: onset of

delirium, patient's advanced age, severity of initial injury, complicated hospital stay prior to admission to acute rehab unit, and his complex list of previous comorbidities. Factors which promoted the patient's recovery included family support and access to health care and comprehensive stroke rehabilitation team.

The decision to discharge to TCU prior to meeting all goals was made by the patient, family and interprofessional health care team due to the patient's slow progress, for he was no longer a candidate for three hours of intensive therapy daily in an acute rehabilitation setting. Also, the patient no longer required the intense level of medical supervision provided in the acute rehabilitation unit. Recommendations for continued therapy included right LE strengthening, functional transfer training with sliding board, bilateral LE weight bearing, and seated or standing controlled mobility tasks. Ultimately, the patient did benefit from therapy services in acute rehab, but due to his slow progress, it was more appropriate for him to be discharged to TCU with continued physical therapy, occupational therapy, and speech language pathology.

CHAPTER V

DISCUSSION

During the patient's stay in acute rehab, he improved in right body and trunk motor control and he developed increased safety and independence with functional tasks. The combination of physical therapy interventions helped the patient achieve these outcomes. The patient responded especially well to interventions that were task and function oriented. Despite the fact that the patient did not achieve all rehabilitation goals and was unable to return home, the interdisciplinary team was confident that he would make consistent, steady progress with continued therapy services. Factors that helped promote the patient's recovery included family support and access to health care and comprehensive stroke rehabilitation team.

At time of discharge the therapy staff was unable to predict if the patient would return to his prior level of function due to a variety of factors.[14] The patient's onset of delirium, patient's age, severity of initial injury, complicated hospital admission, and complex list of comorbidities are all negatively contributing factors to the his stroke rehabilitation.

The onset of delirium during the second week of treatment is of clinical significance. According to a study performed by Dostovic et al[31], patients who had experienced delirium were at greater risk for mortality and greater functional disability within the first year following stroke when compared to patients without delirium. While the patient was delirious, he was unable to follow commands and participate effectively in his therapy sessions. Therapy sessions were focused on functional tasks and increasing independence; however, it can take up to 20 hours or more of practice for successful relearning of such tasks.[32] The patient's limited participation

while symptomatic negatively impacted his stroke recovery. This is one hypothesis why the patient did not meet all functional goals when in the acute rehab setting. Although his delirium slowed his cognitive and motor function recovery, the factors discussed above that helped promote his recovery played an important role in his progress once his symptoms of delirium had subsided.

Although the patient made slow progress with right LE and trunk motor control, no motor function was gained in the right UE. Initial interventions for the right UE were focused on passive range of motion and injury prevention strategies. It is well known that during the acute phase of stroke, early passive range of motion can lead to greater improvement in motor function within the first three months.[25, 26] After the first week of treatment, physical therapy interventions focused on maintaining a comfortable and injury-free arm, however occupational therapy continued to address right UE motor control and hand dexterity with limited progress. Greater progress in occupational therapy was made with compensatory strategies, for the patient was able to manage his paretic limb with his left UE upon discharge. Kwakkel et al[33], reported that the strongest clinical factor in predicting hand dexterity at six months is the initial severity of paresis of the limb. In their study, patients that did not achieve a Fugl-Meyer UE score of 19 points within four weeks had limited potential for return of functional UE dexterity. In accordance to this study, because the patient did not regain UE function within one month, it is unlikely that the patient will regain UE motor function and dexterity long term. Therefore, further interventions should continue focusing on right UE injury prevention and compensatory strategies.

In the future, more research is needed on the effects of delirium on stroke rehabilitation and interventions for regaining motor function and dexterity in a flaccid UE. Currently, many therapists working in stroke rehabilitation are challenged with tailoring evidence-based

interventions.[34] This is because stroke presentation is vastly different from patient to patient, thus it is important that therapy is individualized to meet a patient's needs. Although many clinical and research interventions exist in stroke rehabilitation, no Clinical Practice Guidelines (CPGs) are available for stroke rehabilitation. Some physical therapy approaches show promise in improving motor function prognosis, but a combination of interventions is needed to meet the individual needs of a patient and to maximize motor function recovery.

Reflective Practice

When treating a patient following a stroke in an inpatient rehab setting it is important for a PT to understand potential impairments based on stroke location, factors that can influence a patient's stroke recovery, and the importance of individualizing treatment interventions due to the dynamic, multifactorial nature of stroke presentation. These were all aspects of care that were investigated during and following treatment of this patient in acute rehab. This information helped the health care team to deliver individualized care to the patient and helped in personal knowledge growth as a physical therapy student. Continued expansion of knowledge in the field of stroke rehabilitation is important to guarantee the provision of exceptional patient care during stroke recovery.

Changes that could be made to the plan of care include incorporating more interventions to promote right UE motor function, such as Constraint-Induced-Movement-Therapy (CIMT) or mirror therapy. Both of these interventions have been shown to improve patient's ability to perform motor tasks with a paretic upper extremity.[35, 36] Although occupational therapy was providing the patient with interventions to promote upper extremity function, they patient may have benefitted from these additional strategies. The patient's recovery status was largely dependent on the interprofessional collaboration between the therapy disciplines. As a second-

year physical therapy student, the initiative to ensure that this collaboration was being executed in every aspect of this patient's care, may have been lacking. Improved communication with other therapists may have allowed for better incorporation of treatment aspects into the patient's physical therapy sessions while maintaining individual scope of practice. However, this may not have significantly negatively affected the patient's outcome because treatment was overseen by a clinical instructor who ensured optimal care across the disciplines was being delivered.

Patient and family education regarding the long-term prognosis was another aspect of the patient's treatment that could have been improved. There are many factors that contribute to stroke outcome and if during physical therapy treatment a better understanding of these factors would have been portrayed, it may have allowed more concise and accurate delivery of education to the patient and his family. In particular, aspects of prognostic education that were absent during physical therapy sessions was the effect of delirium on prognosis and the patient's predicted long-term recovery of motor function. In patients who have survived a stroke, studies have reported that patients over the age of 65, patients with extensive motor impairments, and patients with a history of sleep apnea all have and increased risk for developing delirium.[37,38,39] Gustafson et al[38] added those having had suffered a stroke in the left hemisphere were also linked with an increased risk for delirium post-stroke. All of these risk factors for delirium are relevant to this patient and this information could have been beneficial when education the patient and family about his prognosis.

In addition to information regarding delirium, they patient and his family may have benefitted from additional education related to his UE motor function prognosis. The Fugl-Meyer Upper Extremity (FM-UE) Scale of Motor Impairment is the most commonly used tool for assessing post-stroke impairment. The FM-UE categorizes functional impairments at the

shoulder, wrist, hand, and with overall coordination and speed.[40] Utilization of the FM-UE with the patient could have helped predict arm function outcome at six months and allowed me to provide the patient with more accurate education regarding a prognostic prediction of motor recovery in his flaccid hemiplegic arm.[33]

This case has influenced my professional development by expanding my knowledge of stroke recovery in an acute rehab setting. This patient scenario allowed me the opportunity to seek out additional resources for patient treatment secondary to limited hands-on experience in stroke rehabilitation. During the patient's admission to acute rehab, factors were researched that affect stroke recovery, interventions for injury prevention and protection of hemiparetic upper extremities, and the importance of early recognition of signs and symptoms indicating delirium. This case illustrated the importance of self-reflection and incorporating evidence-based research into individualized treatment plans for patients following a stroke. Working with this patient promoted self-motivation and self-education on aspects of stroke rehabilitation which will promote improved delivery of care to future patients.

APPENDIX A.

Postural Assessment Scale for Stroke Patients (PASS) Scoring Form

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Maintaining a Posture

Give the subject instructures for each item as written below. When scoring the item, record the lowest response category that applies for each item.

1. Sitting Without Support

Examiner: Have the subject sit on a bench/mat without back support and with feet flat on the floor.

___(3) Can sit for 5 minutes without support
___(2) Can sit for more than 10 seconds without support
___(1) Can sit with slight support (for example, by one hand)
___(0) Cannot sit

2. Standing With Support

Examiner: Have the subject stand, providing support as needed. Evaluate only the ability to stand with or without support. Do not consider the quality of the stance.

___(3) Can stand with support of only 1 hand
___(2) Can stand with moderate support of 1 person
___(1) Can stand with strong support of 2 people
___(0) Cannot stand, even with support

3. Standing Without Support

Examiner: Have the subject stand without support. Evaluate only the ability to stand with or without support. Do not consider the quality of the stance.

___(3) Can stand without support for more than 1 minute and simultaneously perform arm movements at about the shoulder level
___(2) Can stand without support for 1 minute or stands slightly asymmetrically
___(1) Can stannd without support for 10 seconds or leans heavily on 1 leg
___(0) Cannot stand without support

4. Standing on Nonparetic Leg

Examiner: Have the subject stand on the nonparetic leg. Evaluate only the ability to bear weight entirely on the nonparetic leg. Do not consider how the subject accomplishes the task.

___(3) Can stand on nonparetic leg for more than 10 seconds
___(2) Can stand on nonparetic leg for more than 5 seconds
___(1) Can stand on nonparetic leg for a few seconds
___(0) Cannot stand on nonparetic leg

5. Standing on Paretic Leg

Examiner: Have the subject stand on the paretic leg. Evaluate only the ability to bear weight entirely on the paretic leg. Do not consider how the subject accomplishes the task.

___(3) Can stand on paretic leg for more than 10 seconds
___(2) Can stand on paretic leg for more than 5 seconds
___(1) Can stand on paretic leg for a few seconds
___(0) Cannot stand on paretic leg

Maintaining Posture SUBTOTAL _____

Changing a Posture

6. Supine to Paretic Side Lateral

Examiner: Begin with the subject in supine on a treatment mat. Instruct the subject to roll to the paretic side (lateral movement). Assist as necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

7. Supine to Nonparetic Side Lateral

Examiner: Begin with the subject in supine on a treatment mat. Instruct the subject to roll to the nonparetic side (lateral movement). Assist as necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

8. Supine to Sitting up on Edge of the Mat

Examiner: Begin with the subject in supine on a treatment mat. Instruct the subject to come to sitting on the edge of the mat. Assist as necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

9. Sitting on Edge of the Mat to Supine

Examiner: Begin with the subject sitting on the edge of a treatment mat. Instruct the subject to return to supine. Assist as necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

10. Sitting to Standing Up

Examiner: Begin with the subject sitting on the edge of a treatment mat. Instruct the subject to stand up without support. Assist if necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

11. Standing Up to Sitting Down

Examiner: Begin with the subject standing. Instruct the subject to sit on the edge of mat without support. Assist if necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

12. Standing, Picking Up a Pencil from the Floor

Examiner: Begin with the subject standing. Instruct the subject to pick up a pencil from the floor without support. Assist if necessary. Evaluate the subject's performance on the amount of help required. Do not consider the quality of performance.

___(3) Can perform without help
___(2) Can perform with little help
___(1) Can perform with much help
___(0) Cannot perform

Changing Posture SUBTOTAL_____ TOTAL____

APPENDIX B.

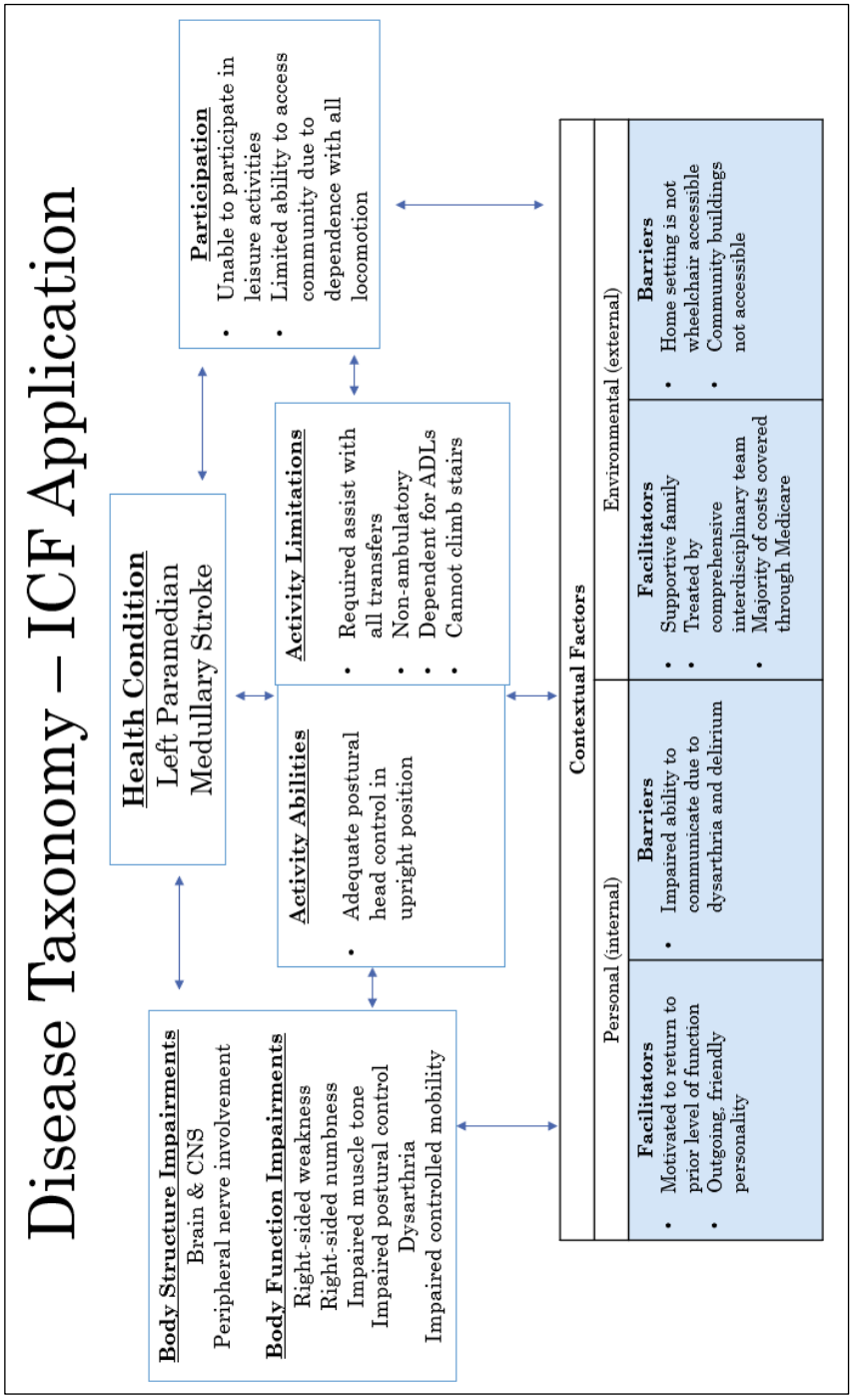

Figure B-**1**. ICF Application for Patient with Left Medullary Stroke.

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