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Multimodal Physical Therapy Management Of A Patient With Unilateral Neglect Post-Stroke In An Outpatient Setting: A Case Report

Meghan Riley
University of New England

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Meghan Riley

M Riley, BS, is a DPT student at the
University of New England, 716 Steven's Ave. Portland, ME 04103
Address all correspondence to Meghan Riley at: mriley5@une.edu

The patient signed an informed consent allowing use of medical information for this report and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act.

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ABSTRACT:

Background and Purpose: Unilateral neglect (ULN) syndrome negatively affects recovery post-stroke and is often associated with falls, longer stays in rehabilitation, and the need for more assistance at discharge. Typical physical therapy treatments include voluntary trunk rotation, visual scanning exercises, mirror therapy, hemispheric activation, sensory awareness training, and lower extremity loading but the efficacy of these treatments is still unclear. The purpose of this case report is to describe multimodal physical therapy (PT) management that includes common PT interventions to alleviate symptoms of ULN and report upon the outcomes of the various treatment methods for rehabilitation of neglect during functional mobility.

Case Description: 65 year-old male referred to outpatient PT following diagnosis of right hemispheric basal ganglia bleed presenting with impaired functional mobility primarily due to significant ULN. The patient was treated with the following interventions for 26 visits over 10 weeks: functional training, increased weight bearing activities, hemispheric activation, voluntary trunk rotation, visual scanning, mirror therapy, sensory awareness training, and gait training. Data collection included: 6 Minute Walk Test (6MW Test), gait speed, manual muscle testing (MMT), and level of assistance during functional task analysis.

Outcomes: Overall improvement in the patient's level of assistance with bed mobility and transfers was noted. Patient improved in 6MW Test from 90 ft. preintervention to 185 ft. postintervention reflecting increased functional status and a small meaningful change.[19] Patient also improved in gait speed from 0.25 ft/sec preintervention to 0.51 ft/sec postintervention.

Discussion: Using multimodal physical therapy management and applying an assortment of interventions developed for the rehabilitation of ULN post-stroke appeared to be beneficial for the patient in increasing awareness of left hemi-side, functional mobility, and status.

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A. BACKGROUND and PURPOSE:

Stroke is a leading cause of long-term disability, which results from brain cell damage due to either an interruption of the blood supply to the brain or hemorrhage into the brain tissue.[7] Although the relative risk of stroke death fell by 35.1% and the actual number of stroke deaths declined by 21.2% from 2001 to 2011, each year about 795,000 people continue to experience a new or recurrent stroke.[8] A common behavioral syndrome of stroke is unilateral neglect (ULN) with an incidence varying widely from 10% to 82% following right-hemispheric stroke. ULN is defined as the failure to report, respond, or orient to stimuli presented contralateral to a brain lesion; if the failure to respond can be accounted for by either sensory or motor deficits, it is not considered to be neglect.[9] According to the current literature, ULN has a negative influence on functional recovery and is associated with a poor functional outcome following a stroke,

therefore several rehabilitative approaches have been proposed and implemented to decrease neglect and improve patient recovery.[10]

As reported by Pierce et al, the physical therapy (PT) interventions that have shown therapeutic effectiveness are hemispheric activation approaches and trunk rotation therapy. In addition, a few authors support visual scanning exercises and mirror therapy, as well as sensory awareness and spatial organization training.[6,11,12,13] Due to current evidence showing ULN slows recovery of the ability to bear weight through the paretic lower extremity for symmetrical performance, findings suggest that paretic lower extremity loading may be an appropriate focus of intervention.[14]

Although many research articles have been published on ULN negatively affecting post-stroke functional mobility and recovery, there is a lack of information on the efficacy of PT interventions to decrease neglect symptoms. Due to the wide variety of clinical presentations and the complex nature of ULN syndrome in patients following stroke, the optimal PT interventions and treatment strategies is unclear. Thus, the purpose of this paper is to describe physical therapy management strategies used during an outpatient rehabilitation stay for a patient with ULN post-stroke.

B. CASE DESCRIPTION: Patient History and Systems Review:

The patient was a 65-year-old male admitted to a hospital-based outpatient physical therapy facility following a right basal ganglia hemorrhagic stroke, which occurred 9 weeks prior to outpatient PT admission. At onset of stroke, the patient was acutely admitted to the hospital where a computerized tomography (CT) scan and neurosurgical evaluation was conducted. The CT scan, CT angiogram, and magnetic resonance imaging (MRI) were positive for a large right basal ganglia bleed with a mild mass effect and negative for an aneurysm or arteriovenous malformation. The right basal ganglia bleed etiology was deemed to be due to hypertension. Prior to his outpatient PT admission, the patient received inpatient PT services for 5 days and home health PT services for 3 weeks. Related past medical history included: hyperlipidemia, hypertension, Type II diabetes, unoperated inguinal hernia, alcohol abuse, depression, and percutaneous endoscopic gastrostomy (PEG) tube placement for nutritional support due to impaired swallowing. See Table 1 for patient medications being taken at admission.

Table 1. Medications at Admission

Medication:	**Indication**:	**Adverse Reaction:**
AmLODIPine	Hypertension	Fatigue, dizziness, nausea, peripheral edema
Cholecalciferol	Dietary supplement (Vitamin D)	Weakness, nausea/vomiting, muscle/bone pain, polyuria, weight loss
Doxazosin	Hypertension	Dizziness, headache, nausea, edema
Insulin Aspart (Novolog FlexPen)	Type II Diabetes	Edema, hypoglycemia
Labetalol	Hypertension	Dizziness, fatigue, hypotension, muscle cramps
Lantus	Type II Diabetes	Hypoglycemia

Lexapro	Depression	Insomnia, dizziness, fatigue, nausea, irritability, muscle cramping, dyspnea
Simvastatin	Hyperlipidemia	Upper respiratory tract infections, headache, abdominal pain, constipation, nausea, myopathy
TraMADol	Pain, when necessary (PRN)	Dizziness, drowsiness, headache, constipation, nausea, weakness

UNE Drug Facts and Comparisons Database

Prior to stroke, the patient worked full-time as a medical supply manufacturer and stated he enjoyed outdoor activities such as hiking and camping. The patient affirmed his willingness to participate in the physical therapy plan of care and in this case report. He indicated that he wanted to improve mobility of his left arm and leg, as well as walk independently. The findings of the system's review are summarized in Table 2.

Table 2. Systems Review

Cardiovascular/Pulmonary			
Right		**Left**	
Intact		Slight edema of lateral ankle and hand (non-pitting)	
Musculoskeletal			
Right	**Left**	**Posture**	
Intact	Impaired lower extremity strength, Impaired lower extremity range of motion	Impaired posture in sitting – reduced lumbar lordosis; Increased lateral trunk lean to right observed in sitting and standing	
Neuromuscular			
Right	**Left**	**Balance**	**Gait**
Intact	Impaired lower extremity tone, impaired lower extremity sensation, impaired lower extremity coordination	Intact sitting balance, impaired standing balance	Impaired
Integumentary			
Right		**Left**	
Intact		Intact	
Communication			
Intact			
Affect, Cognition, Language, Learning Style			
Alert, Impaired cognition demonstrated by impaired left-side awareness, Demonstration and explanation, Education given to patient and caregiver			

C. Clinical Impression #1:

Following the subjective history and systems review, the patient's suspected primary problem is impaired cognition resulting in left unilateral neglect (ULN) from a right basal ganglia cerebral vascular accident (CVA). Due to left ULN, it is hypothesized that the patient's use of his left upper and lower extremities has been limited following his stroke affecting his functional recovery. It is also suspected that decreased use of his left hemiparetic side would lead to impaired left extremity strength, range of motion,

coordination, balance, and gait. Although the patient was given the medical diagnosis of CVA, a potential differential diagnosis to this case would be conversion disorder.

Based on the patient's medical diagnosis and systems review, additional tests and measures that seemed pertinent to conduct in order to confirm or refute the hypothesis include: manual muscle testing (MMT), range of motion (ROM), muscle tone, light touch sensation, proprioception, functional task analysis, gait analysis, Timed Up and Go (TUG) test, Berg Balance Scale, and 6-Minute Walk Test (6MWT). Because the patient was receiving concurrent outpatient occupational therapy (OT) services to address his upper extremity impairments, the tests and measures would primarily focus on the patient's left lower extremity. In addition, it seemed pertinent to schedule a consultation with the patient's occupational therapist regarding findings from the OT initial examination.

The patient continues to be an appropriate candidate for this case report because of the significant functional limitations impeding his quality of life following his stroke and the decreased left-sided awareness initially noted during the systems review. In addition, there is limited publication on the optimal PT interventions and treatment strategies in patients with ULN syndrome post-stroke.

D. Examination:

Upon admission a standardized PT examination was conducted. The data collected is shown in Table 3. The patient's right lower extremity was also assessed during the PT examination; the data is not displayed in Table 3 because findings were within normal limits.

Table 3. Measures of Impairment at Admission

Tests & Measures	Initial Examination Results	Psychometric Properties
Manual Muscle Testing (MMT)		
Left LE strength	• Hip flexion: 3-/5 • Hip extension: 2-/5 • Hip abduction: 2-/5 • Hip adduction: 2/5 • Knee flexion: 0/5 • Knee extension: 3-/5 • Ankle dorsiflexion: 0/5 • Ankle plantarflexion: 0/5 • Ankle eversion: 0/5 • Ankle inversion: 0/5	Good reliability and validity.[2]
Range of Motion (ROM)		
Left hip flexion	95 degrees	• Content validity ensured by clinician's accurate application of knowledge, skills, and interpretation.[1] • Reliability of
Left hip abduction	10 degrees	
Left knee extension	0 degrees	

Left ankle dorsiflexion	0 degrees	goniometry depends on many factors.[1]
Muscle Spasticity (Modified Ashworth Scale) [3]		
Left hip extensors	2	No psychometric properties
Left hip adductors	2	
Left knee extensors	1+	
Left ankle plantarflexors	3	
Sensory Integrity		
Left LE Light touch test [3]	Absent	
Left LE joint position sense proprioception test [3]	Absent	
Functional Task Analysis		
Bed mobility	Min assist for left-side awareness	
Transfers	Min assist for left-side awareness	
Wheelchair mobility	Mod verbal cueing for left-side awareness	
Gait Analysis		
	• Decreased right step length, decreased left mid-stance phase • Left genu recurvatum • Right lateral trunk lean	

LE = lower extremity; ROM = range of motion (measured in degrees with goniometer); LE strength measured via manual muscle testing (maximum score = 5 indicating normal strength)[2]; Muscle spasticity measured via Modified Ashworth Scale (MAS), (0 = no increase in muscle tone, 4 = affected part rigid in flexion or extension)[3]

E. Clinical Impression #2:

Evaluation:

Based on the examination findings, the initial impression of ULN syndrome was confirmed by decreased left-side awareness of personal and extrapersonal space during functional task analysis including bed mobility, transfers, and wheelchair mobility; these findings are consistent with ULN in patients post-stroke. In addition, the patient presented with left lower extremity weakness, absent left lower extremity sensation, absent left lower extremity proprioception, and decreased left lower extremity weight bearing during ambulation. These impairments have significantly decreased the patient's safety within the household and community, as well as limited his functional mobility needed in order to perform ADLs and instrumental activities of daily living (IADLs). ULN, being the primary problem, has reduced the patient's overall use of his affected left extremities during daily activities decreasing his rate of recovery post-stroke.

The patient continues to be appropriate for this case due to his significant impairment of left ULN as demonstrated by functional task analysis resulting in impaired left personal and spatial awareness, impaired left motor output, and impaired left somatosensory input.

Physical Therapy Diagnosis:

Given the patient's medical diagnosis and multisystem impairments, a primary diagnosis from the *Guide to Physical Therapy Practice* can be selected. The primary diagnosis, "Pattern 5D: Impaired Motor Function and Sensory Integrity Associated with Nonprogressive Disorders of the Central Nervous System – Acquired in Adolescence or Adulthood", was chosen due the patient's abnormalities of sensory and motor function from a nonprogressive incident. The relevant ICD-9-CM code, 431 Intracerebral hemorrhage, was selected due to its correlation to the patient's diagnosis of CVA, specifically a right basal ganglia hemorrhage.

Prognosis:

Due to the size of the patient's CVA, severity of impairments, comorbities and the reviewed research articles, the prognosis for this patient to attain significant functional gains is guarded. According to the literature, the presence of unilateral neglect has been associated with poor motor recovery, higher disability, and poor responses to rehabilitation services. A natural logistic pattern in improvement of neglect explained by progression of time post-stroke alone was found and significant for 12-14 weeks post-stroke.[4] This timeline is similar to the recovery pattern of other neurological impairments such as strength and synergism. Although this timeframe explains the recovery of impairment, it does not take compensatory strategies into consideration. Compensation, also known as recovery of activities, will most likely account for some recovery in later weeks (> 3 months) which supports the importance of the continuation of rehabilitation.[4] Because this patient was 9 weeks post-CVA at the date of admission and with support from the current literature, the patient would benefit from skilled PT for 45 minutes 2-3 times a week for at least 12 weeks to decrease impairment and increase functional mobility.

Plan of Care:

Due to the patient receiving concurrent OT treatment, it was necessary to regularly consult with the patient's occupational therapist to discuss his results, findings, and assessment of the patient's status. Further testing of the visual system should have been conducted to rule out a possible field cut and a referral to an ophthalmologist might have been appropriate. Further PT tests and measures include the TUG test, Berg Balance Scale, and 6MWT to assess balance, fall risk, and gait speed. The patient was re-evaluated and tests and measures were conducted every 10 visits as to follow the patient's insurance requirements.

The plans for procedural interventions provided include: patient or client related instruction, electrical stimulation, ADLs (bed mobility and transfers), assistive device/equipment training, injury prevention education regarding falls and use of devices, balance training, gait and locomotion training, posture training, and therapeutic exercises. In addition, there was a strong emphasis on hemispheric activation approaches, trunk rotation exercises, visual scanning exercises, mirror therapy, sensory awareness and spatial organization training, and increased weight bearing through the affected left extremities.

The patient will be discharged from outpatient PT when he has met his goals, has demonstrated a plateau in functional gains, or would no longer like to receive PT services. See patient goals for PT in Table 4 below.

Table 4. Patient Goals for PT

Short Term Goals (3 weeks)	Long Term Goals (6 weeks)
Patient will require modified independence to supervision with wheelchair to mat and sit to stand transfers.	Patient will achieve maximum left lower extremity strength to assist with functional mobility.
Patient will ambulate short, level distances requiring modified independence to supervision using a forearm crutch or quad cane.	Patient will demonstrate independence with his home exercise program (HEP).
Patient will tolerate a 6MWT and TUG test.	Patient will demonstrate ambulation requiring modified independence using the least restrictive device for functional distances on all surfaces.
Patient's wife will demonstrate a safe guarding technique to carry out a walking program at home.	Patient will demonstrate improved balance according to the Berg Balance Scale, 6MWT, and community mobility.

INTERVENTION:

Coordination, Communication, Documentation:

Because of the complexity of this patient's diagnosis and symptoms, there was coordination with his primary care physician (PCP), occupational therapist (OT), caregivers, and insurance provider in order to include all of the parties involved with this individual. The patient's plan of care required communication with the patient, his caregivers, the OT, and his PCP to maintain updated on the patient's status and relay pertinent information to the other healthcare professionals. Documentation was inputted into the outpatient facility's electronic medical records and included the patient's initial evaluation, daily notes, progress notes, and re-examination reports.

Patient/client-related instruction:

The patient and family members participating in caregiving were educated on the patient's diagnosis and the level of assistance he required for bed mobility, transfers, and ambulation. The caregivers required training to properly assist the patient with bed mobility, positioning, transfers and ambulation within the household. The patient and family members were educated on ULN and the importance of the patient to actively engage his left extremities as well as consistently scan the environment to his left. The patient and caregivers were educated on common secondary impairments that may occur following a stroke including deconditioning, decreased range of motion, muscle disuse weakness, and decreased cardiovascular fitness. The patient's spouse was informed about the importance of implementing a walking program within the household to decrease the risk for secondary impairments. In addition, the patient and his caregivers were educated

on the plan of care including frequency, duration, and the anticipated treatment during PT.

Procedural Interventions:

Because the patient had a stroke 9 weeks ago and sustained significant impairments, the patient required frequent PT treatments to maximize safety and optimize functional mobility. Since one of the substantial limiting factors to the patient's recovery was left ULN and because the literature states that improvement of ULN occurs within 12-14 weeks post-stroke, physical therapy treatment for 45 minutes, 3 days a week for at least 14 weeks was beneficial in order to achieve functional gains.[4] This frequency and duration was aimed to decrease and prevent further learned non-use of the left hemiparetic extremities. It was also important to consider compensatory strategies that will most likely account for recovery in later weeks during treatment.

The research has shown ULN to have a considerably negative influence on functional recovery and its association with poor functional outcome following stroke; therefore, the patient's primary interventions included treatments commonly used to decrease symptoms of ULN. [6] See Table 5 for the interventions applied to improve the patient's ULN syndrome. The intensity, frequency, and duration of the exercises were dependent on the patient's fatigue and sustained motor control throughout the exercise. The exercises were stopped when the patient verbalized the need for a rest or when the patient presented with decreased motor control.

Because the patient required assistance at home and presented with decreased safety with functional mobility, the PT co-interventions included: patient/client related instruction, transfer training, bed mobility, device/equipment use and training, balance training, gait/locomotion training, and aerobic capacity/endurance conditioning. These co-interventions applied had a strong focus on safety, left-side awareness, and left upper and lower extremity weight bearing. In addition, left extremity muscle strength and coordination were addressed during those functional training activities.

Initially, the application of functional training in self-care and domestic life including bed mobility training, transfer training, and injury prevention education was pertinent for the patient and caregivers in order to maximize safety within the household and to increase the patient's independence performing daily functional activities. The progression of the patient's interventions heavily relied on his decreased need for assistance and capability performing those functional tasks.

The patient demonstrated compliance with the procedural interventions implemented by attending the majority of his scheduled appointments. The patient did not engage in his home walking program daily because of his spouse's work schedule and the required supervision he needed when ambulating.

Table 5. Interventions for Unilateral Neglect

	Description	Purpose and Supporting Research
Hemispheric activation approach	• The patient actively performed supine left straight leg raises and sidelying left hip abduction exercises.	• Active movements of the contralesional upper or lower extremity have significantly improved walking trajectory and reading.[10] • Limb activation exerts its benefit by virtue of its effects on overlapping neural systems

		representing personal (body surface) and peripersonal (near body) space. When the left limb is used, there is enhancement of the left portion of the representation of personal space. When the left limb is used in the left hemispace, this enhancement is accompanied by corresponding activation of the left portion of the peripersonal representation.[10]
Trunk rotation therapy	• The patient performed trunk rotation and excursion exercises with his hands clasped together in standing to neglected left side. • The patient engaged in left trunk rotation with hands clasped together prior to sitting and standing when performing sit to stand exercise.	• To increase attention to the left neglected hemispace • Studies have shown that rotating the trunk to the left improves latencies to detect targets in the left visual field.[10]
Visual scanning exercises	• The patient ambulated in gym using a narrow-based quad cane requiring contact guard assistance while scanning environment for cones. The cones were predominantly placed on the left affected side of the patient.	• To improve attention to the left neglected hemispace • Studies have shown significant improvement in neglect after scanning training.[10] • Research has shown improved visual perceptual processing with visual scanning exercises translating to significantly better visual function and ability to perform ADLs following a stroke.[6]
Mirror therapy	• The patient ambulated within the parallel bars requiring contact guard assistance while looking in a full-length mirror. • A mirror was placed in front of the patient in order to assist with correct postural alignment of his trunk, shoulders, and head when returning from left trunk excursions. The	• To increase attention to the left neglected hemispace • To decrease right lateral trunk lean with ambulation • To improve postural alignment by decreasing bias of head, trunk, and shoulders to right side

	patient was given verbal and tactile cues in order to achieve centered postural alignment.	
Sensory awareness training	• The Bioness L300 Foot Drop System* was applied to the patient's left common peroneal nerve in order to activate the anterior tibilais, peroneus longus, and peroneous brevis to assist with left ankle dorsiflexion and eversion during gait. • The patient performed mini squats requiring contact guard assistance while looking in full-length mirror.	• To increase sensory stimulation to the left lower extremity • Studies have shown that integration of electrical therapy into exercise-active movement mediated by electrical activation of peripheral and sensory-motor mechanisms enhances motor re-learning following damage to the central nervous system.[18] • To improve proprioception of the left knee joint
Left LE loading/weight bearing	• The patient ascended/descended a flight of stairs requiring contact guard assistance and railing on right side. • The patient performed step-ups on a phonebook leading with his right lower extremity.	• To increase left lower extremity weight bearing to improve left-side attention and increase left lower extremity muscle activation. • Evidence shows that neglect slows recovery of the ability to bear weight through the paretic lower extremity for symmetrical performance of a sit to stand.[14] • Compensating with the nonparetic LE during functional activities is attention-demanding and may be less than optimal for performance of challenging, dynamic tasks in complex environments.[14]

*Bioness L300 Foot Drop System, 19 Ha'Haroshet St., PO Box 2500, Industrial Zone, Ra'Anana 43654, Israel; LE = lower extremity; ADLs = activities of daily living

OUTCOME:

The outcome measures assessed at the time of admission and at 19 weeks post-stroke (10 weeks of outpatient PT) are displayed in Table 6. The patient demonstrated improvement in left lower extremity strength, bed/wheelchair mobility and transfers, gait pattern, and 6MWT/gait speed. The gait speed and 6MWT outcome measures are further displayed in Figure 1 and Figure 2, respectively.

Table 6. Measures of Impairment at Admission and 19 weeks Post-stroke

Tests & Measures	**Initial Examination Results**	**Final Measures**	**Psychometric Properties**
Manual Muscle Testing (MMT)			
Left LE strength	• Hip flexion: 3-/5 • Hip extension: 2-/5 • Hip abduction: 2-/5 • Hip adduction: 2/5 • Knee flexion: 0/5 • Knee extension: 3-/5 • Ankle dorsiflexion: 0/5 • Ankle plantarflexion: 0/5 • Ankle eversion: 0/5 • Ankle inversion: 0/5	• Hip flexion: 3/5 • Hip extension: 2/5 • Hip abduction: 2+/5 • Hip adduction: 2+/5 • Knee flexion: 1/5 • Knee extension: 3/5 • Ankle dorsiflexion: 0/5 • Ankle plnatarflexion: 0/5 • Ankle eversion: 0/5 • Ankle inversion: 0/5	Good reliability and validity.[2]
Range of Motion (ROM)			
Left hip flexion	95 degrees	95 degrees	• Content validity ensured by clinician's accurate application of knowledge, skills, and interpretation.[1] • Reliability of goniometry depends on many factors.[1]
Left hip abduction	10 degrees	25 degrees	
Left knee extension	0 degrees	0 degrees	
Left ankle dorsiflexion	0 degrees	0 degrees	
Muscle Spasticity (Modified Ashworth Scale) [3]			
Left hip extensors	2	2	No psychometric properties
Left hip adductors	2	2	
Left knee extensors	1+	1+	
Left ankle plantarflexors	3	3	
Sensory Integrity			
Left LE Light touch test [3]	Absent	Absent	
Left LE joint position sense proprioception test [3]	Absent	Absent	
Functional Task Analysis			
Bed mobility	• *Roll Left*: Min A for	• *Roll Left*:	

	left-side awareness • *Roll Right*: Supervision/Setup • *Roll Supine*: Supervision/Setup • *Supine to Sit*: Min A for left-side awareness • *Sit to Supine*: Min A for left-side awareness	Independent • *Roll Right*: Supervision for proper positioning of left hemiparetic UE • *Roll Supine*: Independent • *Supine to Sit*: Independent • *Sit to Supine*: Independent	
Transfers	• *Sit to Stand*: Min A for left-side awareness • *Stand to Sit*: Min A for left-side awareness	• *Sit to Stand*: Modified Independence • *Stand to Sit*: Modified Independence	
Wheelchair mobility	Moderate verbal cueing for left-side awareness	Minimal verbal cueing for left-side awareness	
Gait Analysis			
	• Decreased right step length, decreased left mid-stance phase • Left genu recurvatum • Right lateral trunk lean	• Right foot step through pattern 50% of time during ambulation • Left genu recurvatum • Right lateral trunk lean 75% of time during ambulation	
6 Minute Walk Test (6MW Test) and Gait Speed			
	• *6MW Test*: 90 ft • *Gait Speed*: 0.25 ft/sec	• *6MW Test*: 185 ft • *Gait Speed*: 0.51 ft/sec *Conducted 19 weeks following stroke	• Reliability value of 6MW Test ranges from 0.88-0.97[15] • 6MW Test is positively associated with treadmill and self report measures of functional performance.[15] • 6MW Test is sensitive in detecting change.[15]
Berg Balance Scale (BBS)			

	Patient unable to perform	• *Berg Score*: 28/56 = medium fall risk *Conducted 19 weeks following stroke	• Porta et al. supports the internal validity and reliability of the BBS. [16]
Timed Up and Go (TUG) Test			
	Patient unable to perform	• TUG Score: Average 61 sec = high fall risk *Conducted 19 weeks following stroke	• Highly reliable [17]

LE = lower extremity; ROM = range of motion (measured in degrees with goniometer); LE strength measured via manual muscle testing (maximum score = 5 indicating normal strength)[2]; Muscle spasticity measured via Modified Ashworth Scale (MAS), (0 = no increase in muscle tone, 4 = affected part rigid in flexion or extension)[3]; Min A = minimum assistance

Figure 1. Gait Speed Outcomes

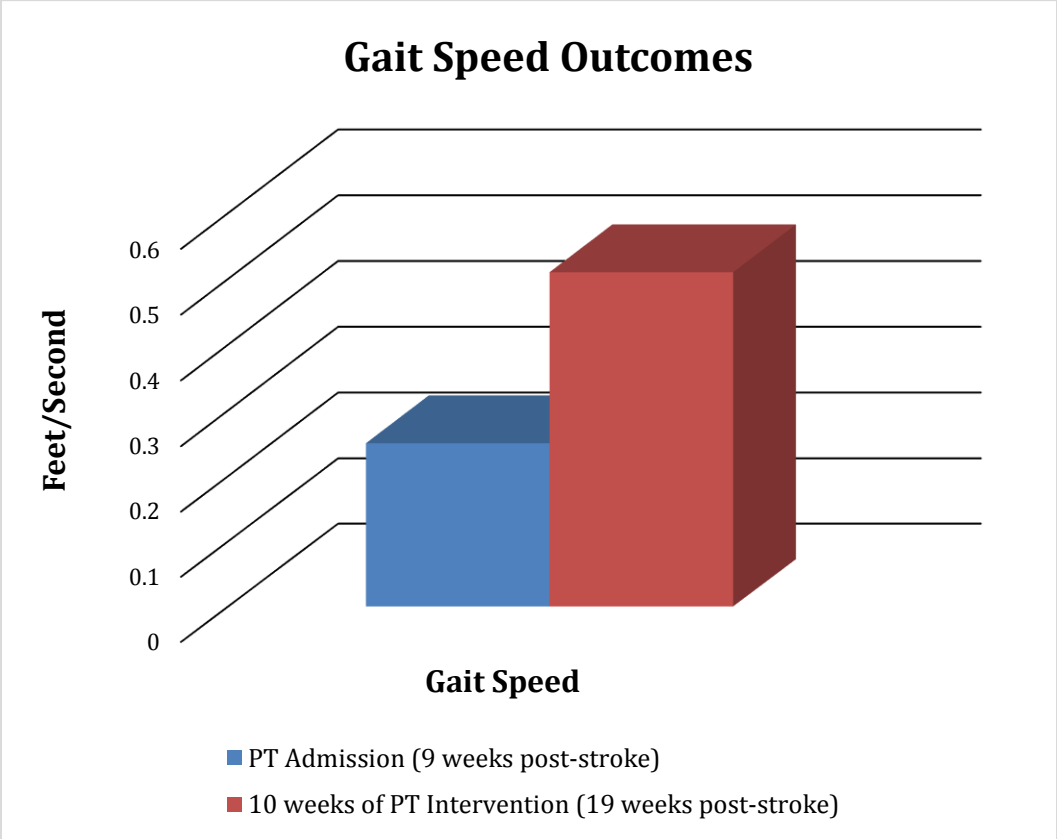
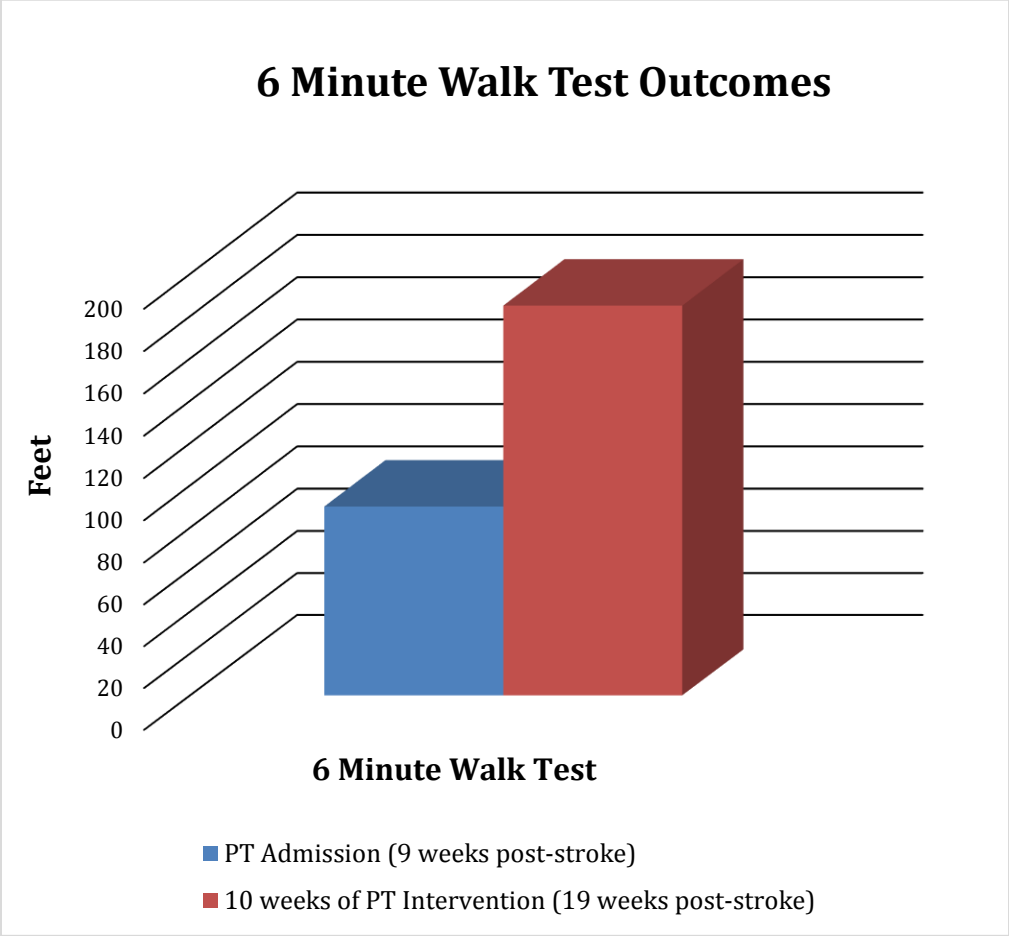


Figure 2. 6 Minute Walk Test Outcomes



DISCUSSION:

The patient had made good progress during the 10 weeks of outpatient rehabilitation. It was felt that the primary focus on the multimodal PT interventions commonly used to decrease ULN syndrome were appropriate given that the patient presented with significantly impaired functional mobility following his stroke due to left-sided neglect. The patient showed improvements in the assistance he required for bed mobility and transfers indicating increased independence and safety within the household. His 6MW Test and gait speed improved suggesting increased overall aerobic and muscular endurance. In addition, he was able to complete the TUG Test and BBS indicating improved balance over the course of treatment. When assessing the patient's progress and functional gains, OT services must also be considered as well as the PT co-interventions applied. Although the therapy provided and family support may have positively influenced the patient's outcome, there were many negative factors he had to overcome. These factors included polypharmacy, cognitive and retention deficits, and multiple comorbidities.

While left ULN is a common symptom following a right-hemisphere stroke, incidence levels ranging from 17-80%, there was a lack of the efficacy of PT

interventions implemented to decrease ULN. The optimal PT interventions and treatment strategies were unclear. The scientific literature provided beneficial information regarding the effectiveness of the following interventions: voluntary trunk rotation, visual scanning exercises, electrostimulation, mirror therapy, and hemispheric activation.[10] In addition, Mercer et al. suggested the possible benefit of a PT intervention focusing on paretic lower extremity loading.[14] These research studies provided many valuable treatments that could be formed into a multimodal treatment plan by the physical therapist in order to reduce the patient's ULN and increase functional status.

Due to the complex nature of ULN syndrome post-stroke, further research is needed to define the subtypes of neglect (motor, perceptual, personal, extrapersonal) prior to implementing the chosen intervention(s).[10] In addition, the effects of treatment appear to be relatively transient requiring many PT visits, so an exploration of whether repeated treatments would result in a greater long-term advantage of reduction of ULN would be beneficial. Lastly, the use of line bisection tests, cancellation tests, the Behavioral Inattention Test (BIT), and the Catherine Bergego Scale (CBS) as objective measures at admission, re-examination, and discharge would be valuable to assess ULN throughout the course of treatment rather than conducting a functional task analysis.

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