INPATIENT REHABILITATION FOR A PATIENT WITH A RIGHT POSTERIOR CEREBRAL ARTERY STROKE, UNILATERAL NEGLECT SYNDROME, AND HOMONYMOUS HEMIANOPIA

A Doctoral Project
A Comprehensive Case Analysis

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by

Haley Bercot

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Abstract

of

INPATIENT REHABILITATION FOR A PATIENT WITH A RIGHT POSTERIOR CEREBRAL ARTERY STROKE, UNILATERAL NEGLECT SYNDROME, AND HOMONYMOUS HEMIANOPIA

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A patient with right posterior cerebral artery stroke was seen for physical therapy treatment for 14 sessions over 15 days at an inpatient physical therapy clinic in Florida. Treatment was provided by a student physical therapist under the supervision of a licensed physical therapist and in conjunction with an occupational therapist and a speech language therapist.

The patient was evaluated at the initial encounter with the Catherine Bergego Scale, Dynamic Gait Index, and Functional Independence Measure, and a plan of care was established. Main goals for the patient were to decrease neglect of the personal, peri-personal, and extra-personal spaces, demonstrate safe performance of functional activities, and increase overall independence. Main interventions used were visual exploration training, limb activation exercises, trunk rotation exercises, and task specific mobility training with obstacles and navigational challenges.

The patient improved awareness of the personal, peri-personal, and extra-personal spaces, demonstrated safety with functional activities, and gained greater functional independence. The

patient was discharged home with a home exercise program and follow up with home health physical therapy.

_____, Committee Chair
Brian Moore, PT, DPT, NCS

_____
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ACKNOWLEDGEMENTS

I acknowledge my clinical instructors for allowing me to learn about and treat patients with neurological disorders as well as allowing me to access information for my case study. I thank my patient for providing me with a wonderful learning experience. I wish him the best of luck on the golf course and with his upcoming road trip to Massachusetts.

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Chapter 1

General Background

According to the American Heart Association, there are 7.2 million individuals living with stroke in the United States.[1] Approximately 795,000 strokes occur per year, about 600,000 of which are first time strokes and 175,000 are recurrent strokes.[1] In the United States, stroke is the leading cause of long term disability and the 5th leading cause of death.[1] The vast majority of strokes are ischemic (87%), caused by the abrupt interruption of blood flow to the brain by a thrombus or embolism.[1] The remainder of strokes are hemorrhagic (13%), resulting from the rupture of a blood vessel either inside the brain or in the subarachnoid space.[1] Smoking, elevated body mass index, hypertension, dyslipidemia, diabetes, physical inactivity, and poor diet are identified risk factors for ischemic stroke.[1,2] Hypertension, alcohol abuse, smoking, and poor diet are risk factors for hemorrhagic stroke.[2] Stroke typically presents with a sharp decline in function during the first hours and days followed by a period of neuronal plasticity and functional recovery that lasts for approximately 12 weeks with a slower rate of recovery seen thereafter.[1]

Only 5-10% of strokes occur in the posterior circulation (PC).[3] Superficial posterior cerebral artery (PCA) stroke is a type of PC stroke that comprises only 3.5% of all strokes[4] affecting the occipital, parieto-occipital, and medial-inferior temporal lobes leading most commonly to acute signs and symptoms including visual field defects (67%),[4] somatosensory deficits, and cognitive impairment such as anterograde amnesia (17.5-30%)[3,4] or spatial working memory deficits.[3,5] The sequalae of impairments caused by lesions to these areas of the brain include ataxic gait patterns, difficulty performing activities of daily living (ADLs), and a high potential for collisions and falls.[6] Unilateral neglect syndrome (UNS) is the “failure to report, respond, or orient to novel or meaningful stimuli presented to the side opposite of the brain

lesion when this failure cannot be attributed to either sensory or motor deficits."[7] Hemi-spatial neglect has a prevalence of 80% in acute right hemisphere strokes, 20% in acute left hemisphere strokes, and 23% in chronic stroke, though reported rates vary dependent on the aspects of UNS that are screened for and the number, type, and sensitivity of diagnostic tests used.[7,8] The syndrome can manifest as sensory, perceptual, or motor neglect, with a bias of movement toward the ipsilesional side or contralateral hypokinesis. It can be considered representational if an individual ignores the contralesional half of mental images. Spatial neglect manifests in the close or personal, reaching or peri-personal, and far or extra-personal spaces. Unilateral neglect syndrome is also associated with lack of insight into deficits, global attentional deficits, and lower levels of motivation.[9] Patients with UNS often have difficulty with functional tasks such as cooking, reading, and walking without colliding into walls or doorways.[7]

Unilateral neglect syndrome can be accompanied by sensory and/or motor deficits.[7] Due to common cerebral circulation and neural pathways serving the perceptual and sensory systems in the posterior parietal lobe, visual field deficits are commonly found in individuals with UNS. Visual field deficits are associated with 89% of acute superficial PCA strokes and 25% of all chronic strokes.[4,10] These deficits include homonymous hemianopia (67-74%), quadrantanopia (14-22%) and rare cases of scotoma and cortical blindness.[4,10] Visual field deficits may cause great difficulty with activities such as ambulation, reading, and driving.

There is no indication of poorer long term functional outcomes for rehabilitation of superficial PCA strokes with homonymous hemianopia and UNS compared to strokes without visuospatial deficits.[3] Superficial PCA strokes have a better functional prognosis than other PC strokes acutely and at 30 days status post stroke;[3,4,11] however, both visual field deficits and UNS are known to slow the rate of recovery in the first 3 months.[10,12-14] These deficits show the most improvement in the first 10 days post stroke, less improvement after 1 month, and

negligible improvement after 1 year.[15] Considering visual field deficits, studies have shown only 8-17% of patients experience full recovery and 52% experience no recovery at all;[10] however patients with visual deficits can typically be taught compensations to diminish the negative impact on quality of life.[10] In contrast, patients with UNS have high rates of denial of disability and the presence of UNS is an independent predictor of decreased mobility, decreased function, and institutional discharge destination.[14] Still, other variables, such as length of stay, social support, and status as a widow/widower, influence rate of recovery and discharge destination.[12,14,16-18] Studies have found patients with UNS discharging to home at rates of 60-88%, which were comparable to patients without visuo-spatial deficits, when spending over a month in inpatient rehab and having access to social support at discharge.[10,12]

Chapter 2

Case Background Data

Examination – History

The patient was a 74-year-old recently widowed male who experienced a stroke while operating an SUV at 45-50 mph which led to a motor vehicle accident. He was taken to the hospital and evaluated where a computed tomography scan revealed an ischemic stroke of the right posterior cerebral artery affecting the occipital, posterior parietal, and temporal lobes with no thalamic involvement . After 3 days in acute care, the patient was transferred to an inpatient rehabilitation center. There were no reports of loss of consciousness or incontinence.

The patient presented to physical therapy seated in the right half of his wheelchair (w/c) with his body rotated approximately 30 degrees to the right and both his head and gaze oriented to the right of his body's midline. His left foot was tucked under the right front wheel of the w/c and his right leg was placed outside of the base of the w/c. In ambulation he demonstrated a wide stance, forward trunk lean, and heavy foot fall, though he was able to ambulate 150 feet (ft) multiple times with contact guard assist and no assistive device. Over the course of the 30 minute (min) objective exam, he totaled 27 collisions with static objects, the majority of which occurred during ambulation with objects positioned on his left side.

The patient's chief complaint was lack of independence. He wanted to resume living independently in his mobile home which had 3 steps to enter and bilateral railing. In the long term, he wanted to resume working 16 hours a week at a golf course, play golf in his free time, and visit family in Massachusetts. The patient did not own any durable medical equipment.

Systems Review

The patient's cardiopulmonary system was impaired: resting blood pressure was 132/79 millimeters mercury (mmHg), and the patient reported a history of hypertension currently

managed with medications. The neuromuscular system was impaired through observation of the patient's seated posture, wheelchair mobility, gait, and transfers, though the OT reported that the patient's UE strength was grossly 5/5. The integumentary system was visibly impaired with abrasions on the dorsal surface of both hands and swelling on the patient's forehead, which the patient stated were a result of his MVA. The patient communicated with intelligible speech; however his cognition was impaired based on the admitting nurse's report that the patient had been alert and oriented to person/place but not time.

Examination - Medications

Table 1

Medications[19]

MEDICATION	DOSAGE	REASON	SIDE EFFECTS
Atorvastatin / LIPITOR® (statin)	20 mg tablet	Dyslipidemia	Headache, joint pain, confusion, forgetfulness, diarrhea, constipation
Tamsulosin/ FLOMAX® (alpha-1 blocker)	04 mg tablet	Benign prostatic hyperplasia	Dizziness, drowsiness, headache, orthostatic hypotension
Cholecalciferol/ Vitamin D3	1,000 international units injection	Vitamin D insufficiency	Itching, hives, mouth tingling, chest tightness (signs of allergic reaction)
Fenofibrate/ TRICOR®	48 mg tablet	Dyslipidemia	Constipation, diarrhea, heartburn, headache
Amlodipine/ NORVASC® (calcium channel blocker)	5 mg tablet BID	Hypertension	LE edema, dizziness, upset stomach, drowsiness, flushing
Losartan/ COZAAR® (angiotensin II receptor agonist)	50 mg tablet	Hypertension	Dizziness, lightheadedness, drowsiness, orthostatic hypotension, muscle cramps
Aspirin (anticoagulant)	80 mg tablet	Anticoagulant	GI upset, heartburn
BID=twice daily, GI=gastrointestinal, LE=lower extremity, Mg=milligram			

Chapter 3

Examination – Tests and Measures

The patient's deficits were categorized using the International Classifications of Functioning, Disability and Health (ICF) Model.[20] The Catherine Bergego Scale[21] was used to assess the severity of UNS at the body structure and function level. At the activity level, the Dynamic Gait Index[22] was used to assess instability in gait and the Functional Independence Measure[17] was used as a functional outcome measure as well as a prognostic measure for discharge planning. The visual field confrontation test[23] was used as a diagnostic measure, to detect the presence of visual field deficits.

The Catherine Bergego Scale (CBS) assesses the presence and severity of neglect through observation of 10 tasks of daily living including: limb awareness, use of personal belongings, dressing, grooming, gaze orientation, auditory attention, navigation, collisions during navigation, eating, and cleaning the mouth after a meal. Among all validated measurements of neglect, the CBS is unique in that it assesses neglect in the personal, peri-personal, and extra-personal spaces.[8] The CBS uses a 4 point scale to grade the level of neglect with 0 indicating no neglect and 3 indicating severe neglect. Total scores of 1-10 indicate mild neglect, 11-20 moderate neglect, and 21-30 severe neglect, and these assessment data informed goal setting.[21] The CBS has excellent interrater reliability ($r=0.96$)[21] but has no established intra-rater reliability.[8] It has excellent concurrent validity with the Bell's test, line cancellation test, figure-copying tasks, clock drawing test, and reading tasks; however, it has been shown to be 16-31% more sensitive to detecting neglect than these standard paper and pen exams.[21,24] There is no established gold standard test for UNS, which results in no established standard error of measurement (SEM), minimal detectable change (MDC), or minimal clinically important difference (MCID) for any of the 28 standardized tests of UNS.[8] Given the

heterogeneity of neglect, the current best clinical practice, as per consensus of expert opinion, is to assess neglect using a battery of standardized validated tools including a functional test such as the CBS.[8,24]

The Functional Independence Measure (FIM) is an outcome measure developed specifically for the inpatient rehabilitation setting and widely used to assess general disability at the activity level through 13 motor and 5 cognitive items including eating, grooming, dressing, bowel/bladder management, transfers, wheelchair propulsion, walking, and stair climbing. Each item is scored on a scale from 1 (total assistance) to 7 (total independence). Total FIM scores range from 18 (totally dependent) to 126 (totally independent). The motor subscale of the FIM has demonstrated excellent concurrent validity with the Barthel Index ($r=0.9479$ $p<0.0001$) and Modified Rankin Scale ($r=-0.8894$ $p<0.001$) for measuring disability in patients recovering from stroke.[25] Based on a systematic review of 11 studies of 1,568 patients primarily in inpatient settings, the FIM was found to have excellent overall reliability (ICC_{95} 0.95) as well as excellent interrater reliability (ICC_{95} 0.95), an especially important psychometric as the FIM is often scored by an interdisciplinary medical team.[26] The Uniform Data System for Medical Rehabilitation has established the SEM to be 4.7 based on data from over 150,000 patients, which yields a calculated MDC of 13.[26] The FIM has an established total MCID of 22, an MCID of 17 for the motor subscale and an MCID of 5 for the cognitive subscale.[27] For patients with admission motor scores between 58 and 91, the MCID was found to be 16 and for patients with admission cognitive scores below 18, the MCID was found to be 9.[26] These latter figures determined the subscale goals.

The FIM was used as a prognostic measure as admission FIM scores have been reported to be the strongest predictor of functional outcomes and discharge destination for patients aged 50 and over in an inpatient rehabilitation facility after first stroke.[28] Black et al. found an

admission FIM score greater than 71 to have a sensitivity of 63% and a specificity of 85% for discharge to home.[17] This data yields a positive predictive value of 91% and a negative predictive value of 48%, indicating that nearly 100% of individuals who have admission FIM scores above 71 discharge home while only about half of individuals with admission FIM scores of 71 or below are not discharged home. For this study, mean admission FIM was 69.7, mean age 68.8, patients were evenly divided between right and left hemispheric strokes, and 6% of patients were noted to only have non-motor impairments such as neglect.

The Dynamic Gait Index (DGI) is a performance based measure at the activity level comprised of 8 items, where each item is scored on a 0-4 scale. A score of 0 indicates "severe impairment" and 3 indicates "no impairment". Tasks include steady state walking, walking with changing speeds, walking with vertical and horizontal head turns, obstacle navigation, pivoting, and stair climbing. For patients with stroke, the DGI has been found to have moderate to high concurrent validity with the Berg Balance Scale (r=0.83), the Activity-specific Balance Confidence Scale (r=0.68), the 10m walk test (r=-0.73), and the Timed up and Go (-0.77).[22] For individuals at least 3 months post stroke, the DGI was found to have excellent intra- and inter-rater reliability (ICC_{95} 0.96 and 0.96) with an SEM of .97 and an MDC of 3.[29] The DGI can be used to determine fall risk with a cutoff value of 16.5 for individuals recovering from stroke in inpatient rehabilitation (Sensitivity 60% Specificity72%).[30] There is no established MCID for patients in the acute or subacute phase of stroke.[22] Goals were based on the cut off score of 17.

The Visual Confrontation Field Test with dynamic finger movement was used as a diagnostic test for the presence of visual field deficits. Automated perimetry testing is considered the gold standard for visual field exams as it has the highest sensitivity and specificity for the widest variety of visual deficits; however, the standard confrontation test has consistently been found to have high sensitivity (78-97%) and specificity (90-97%) for

diagnosing deficits specific to the posterior central visual pathways such as homonymous hemianopia in patients post stroke.[31,32] The presence of UNS is a potentially confounding variable; however, Cassidy et al.,[31] demonstrated that the visual confrontation test can be used to identify homonymous hemianopia, quadrantanopia, as well as the change from homonymous hemianopia to quadrantanopia in patients with UNS when compared with oculokinetic perimetry testing in the first month post stroke; however, he found that unlike automated or goldman perimetry, confrontation testing is not sensitive to recovery in the central visual field. Johnson et al.[23] studied the validity of the visual confrontation test in comparison to the automated perimetry test and found visual confrontation testing to be 76% sensitive and 93% specific for homonymous hemianopsia, yielding a positive likelihood ratio of 10.86, which is associated with a large shift in post-test probability, and negative likelihood ratio of 0.26, which is associated with a moderate to small shift in post-test probability. As homonymous hemianopia or quadrantanopia are found in 89% of patients with posterior cerebral artery strokes affecting the occipital lobe,[4] a positive test would increase the post test probability to 99% while a negative test would decrease the post test probability to 68%.

Table 2

Examination Data

BODY FUNCTION OR STRUCTURE		
Measurement Category	Test/Measure Used	Test/Measure Results
Extinction	Confrontation Extinction Test	Positive auditory and tactile extinction
LE Strength	Manual Muscle Test	B Hip F/E/ABD/ADD 4, B Knee F/E 5
Level of Consciousness	AVPU	A & O x 4 unimpaired
Pain	NPRS	0/10 pain – no complaints
Proprioception	Talocrural joint position	Unimpaired
Range of Motion	Gross Range of Motion	Within functional limits
Standing Balance	Kansas University Balance Test	5/5 Standing Balance
Stroke Severity	National Institute of Health Stroke Scale	Total: 7/42 indicating moderate stroke
Tactile Sensation	B LE Light Touch, Pin Prick	Unimpaired
Unilateral Neglect	Catherine Bergego Scale	Grooming: 3 Dressing: 3 Eating: 3 Cleaning: 2 Gaze: 2 Limb management: 3 Auditory attention: 3 Collisions: 3 Navigation: 2 Personal belongings: 3 Total: 27/30 indicating severe neglect
Visual Field	Confrontation Visual Field Test	Left homonymous hemianopia
FUNCTIONAL ACTIVITY		
Measurement Category	Test/Measure Used	Test/Measure Results
Functional Abilities	Functional Independence Measure	Bed Mobility: SPV w/verbal cueing Transfers: sit to sit transfer min assist Wheelchair: 150’ Min Walk: 150’ Min Stairs: 4 SPV w/right rail Comprehension: 3 Expression: 3 Social: 3 Problem solving: 2 Memory: 3 Total Motor: 60/91 Total Cognitive: 14/35 Total Score: 74/126
Stability in Gait	Dynamic Gait Index	8/24
PARTICIPATION RESTRICTIONS		
Measurement Category	Test/Measure Used	Test/Measure Results
Level of Independence	Discharge Setting	Undecided – assisted living facility, independent living facility, or home
A&O=alert and oriented, ABD=abduction, ADD=adduction, AVPU=alert verbal pain unresponsive, B=bilateral, E=extension, F=flexion, LE=lower extremity, Min = minimal, Spv = supervision, W/=with		

Chapter 4

Evaluation

Evaluation Summary

The patient was a 74-year-old male 4 days status post ischemic posterior cerebral artery stroke that affected the posterior parietal, occipital, and temporal lobes. The patient was found to have severe left unilateral neglect syndrome, left homonymous hemianopia, impaired dynamic balance, decreased functional mobility, and to be at risk for falls and collisions. Due to safety concerns due to poor decision-making and judgment, the patient was placed under 24-hour direct supervision.

Diagnostic Impression

The patient's presentation was consistent with the medical diagnosis of posterior cerebral artery stroke. Visuo-spatial impairments at the body structure and function level led to decreased independence in performing daily activities necessary to return to home environment.

Prognostic Statement

Negative prognostic factors for functional independence and home discharge from inpatient rehabilitation within 2-3 weeks included the presence of UNS which has been found to increase the odds of impaired mobility and institutional discharge.[14] In a systematic review, Jehkonen et al., found UNS to be an independent predictor of a poor functional outcome in 11 studies.[33] Other studies, however, have found patients with UNS or UNS in combination with visual field deficits to have comparable functional outcomes to patients without UNS, with home discharge rates ranging from 60-88% for patients with UNS in contrast to 65-96% for patients without UNS; however, in these studies the patients with UNS were given lengths of stay ranging from 64-136 days at inpatient rehabilitation facilities, which was considerably

longer than the current standard practice at the facility where this took place.[12,14,16] The patient's smoking habit has negative prognostic implications.[34] Non-married status is associated with institutional discharge for patients whose FIM scores are <76.[18] Cognitive FIM scores below 21 at admission are associated with institutional discharge, which suggested the patient's cognitive status may have been a significant limiting factor for achieving his goals.[18,28]

The patient's hypertension, hyperlipidemia, and the use of statins have not been found to have a significant impact on functional outcome.[34] Age has consistently been found to have a negligible effect on stroke recovery accounting for approximately 3% of variance.[14,18,28]

Positive prognostic factors included the patient's relatively high admission FIM score of 74,[17] family nearby,[18] absence of dysphagia,[18] and absence of bowel/bladder incontinence which are all associated with improved functional outcomes and home discharge.[35] Higher education as well as an active pre-stroke lifestyle have also been reported as positive prognostic factors.[18]

G-Codes

Current with modifier: G8978 mobility – CK (FIM 41% disabled)

Goal with modifier: G8979 mobility – CJ (FIM 24% disabled)

Discharge Plan

Discharge destination was undetermined. The patient presented with good potential for home discharge based on functional status as measured by the FIM.[17,28] In addition, the patient had a support network including a sister and mother in law living directly next door and 5 children living out of state. Home discharge was largely dependent on increased independence with functional activities as measured by the FIM, recovery of visuo-spatial deficits, improvement of safe judgments in the home environment, and the family's ability to provide

any necessary support.[35] Durable medical equipment needs were likely to be minimal, and a shower chair and grab bars were ordered. A rolling walker was under consideration.

Chapter 5

Plan of Care-Goals and Interventions

Table 3

Evaluation and Plan of Care

PROBLEM	PLAN OF CARE Short Term Goals (1 week)	Long Term Goals (2 weeks)	Planned Interventions Interventions are Direct or Procedural unless they are marked: (C) = Coordination of care intervention (E) = Educational intervention
BODY FUNCTION OR STRUCTURE IMPAIRMENTS			
Unilateral Neglect	Catherine Bergego Score <20 to indicate moderate neglect[24]	Catherine Bergego Score < 11 to indicate mild neglect[24]	- Visual scanning training[6] in standing w/Dynavision[36,37] and w/trunk rotations using Wii Golf.[13,38] - Unilateral limb activation[12] w/lateral stepping in the parallel bars or w/L hand for reaching tasks in standing w/Dynavision[37] or in gait training[12]. - E: Feedback training to increase awareness of deficits and progress.[9]
ACTIVITY LIMITATIONS			
Impaired Functional Mobility	- W/C mobility 300 ft SPV <5 collisions.[6] - Ambulate 200 ft w/RW SPV <5 collisions.[6] - Utilize L hand on rails w/12 stairs SPV w/0-2 VCs.[12] - Perform transfers SPV 0-2 VCs for L limb management.[12] - Rolling in bed SPV 0-2 VCs for L limb management.[12]	- W/C mobility 300 ft mod I <2 collisions.[39] - Ambulate 300 ft SPV <2 collisions.[39] - Utilize L hand on rails w/12 stairs SPV.[12] - Perform Transfers, bed mobility Mod I[12] - FIM motor score increase 16 points, cog increase 9 points, total score increase 22 points.[27]	- Manual w/c task specific training progressing in distance (100-500ft) and physical/cognitive complexity[40] through obstacle avoidance and navigational challenges.[3,41] Collision rate goals set by norms for R CVA patients in HH setting but without neglect[6] and healthy controls.[39] - Over ground ambulation specific training progressing in distance (100-500 ft) and physical/cognitive complexity[40] through obstacle avoidance,[39] treasure hunts,[13,38] and navigational challenges.[3,41] - Bed mobility and transfer specific training utilizing

			beds, chairs, mats, toilets and a vehicle simulator, emphasis on L limb utilization.[12] - Stair climbing specific training progressing 4 to 12 steps B rails.[12]
PARTICIPATION RESTRICTIONS			
Decreased Level of Independence	- Mod I alarmed w/c in room. - Smoking cessation class. - Attend 30% of group therapy sessions for safety ed/peer support/visuo-spatial training.	- Mod I w/c in hospital. - Home/family visit. - Attend 50% of group therapy sessions for safety ed/peer support/visuo-spatial training.	- E/C: Safety lessons are provided daily in independent and group therapy sessions. Key concepts are reviewed via teachback method to ensure patient understanding - E/C: PT/OT lead home visit/family training to review functional mobility, identify durable medical equipment needs, and address safety hazards
B=bilateral, CVA=cerebrovascular accident, ed=education, FIM=Functional Independence Measure, Ft=feet, HH=home health, L=left, Mod I=modified independent, OT=occupational therapist, PT=physical therapist, R=right, RW=rolling walker,SPV=supervision,VC=verbal cues, W/C=wheelchair			

Plan of Care – Interventions

See table 3.

Overall Approach

Patient was seen in inpatient rehabilitation therapy for 14 individual sessions over a 15 day period. Individual sessions lasted 30-60 minutes and included a 2 hour home visit. The overall approach for this patient was a combination of neuromuscular reeducation and task specific training in functional mobility.[7] Neuromuscular reeducation exercises consisted of visual scanning,[13] trunk rotation,[38] and limb activation,[12,37] initially performed in standing utilizing the Wii and Dynavision and then in dynamic activities; such as lateral stepping in the parallel bars and overground ambulation. Task specific training[12] included bed mobility, transfers, wheelchair mobility, and ambulation. Task specific training was initially performed in a closed, familiar environment and progressed to include greater number of obstacles, use of left

upper extremity with reaching tasks, cognitive tasks such as navigation and treasure hunts, and utilization of more open, less familiar environments. Effectiveness of treatments was assessed 3 times per week with the CBS and FIM as well as at discharge with the CBS, FIM, and DGI.

PICO question

For elderly patients with left UNS and homonymous hemianopia in the acute stage of recovery following first stroke, what are the best interventions for increasing visuo-spatial awareness, decreasing disability as measured by the FIM, and increasing odds of discharge to home with a reduced length of stay?

Vahlberg et al., 2008 provided a review of 4 randomized control trials that met their criteria to evaluate physical therapy treatments for patients with neglect following stroke, utilizing control groups, and measured with standardized outcomes including the FIM and Behavioral Inattention Test found moderate evidence for visuo-motor cuing and visual scanning training with lower level evidence in support for the use of additional techniques such as limb activation, trunk rotation, early functional training, and prism glasses as components of a comprehensive therapy program.[7] The following two studies were particularly useful in crafting the patient's plan of care.

Kalra et al., 1997 examined the effects of limb activation and visuo-motor cuing incorporated into early task specific functional training in a group of 25 patients with UNS (without hemianopia) in the inpatient rehabilitation setting.[12] Conventional therapy focusing on "restoration of normal tone, movement patterns, and motor activity"[12] before introduction of functional training was provided to a control group of 25 patients who were comparable for age, gender, diagnosis, and initial Barthel Index scores. The patients in the experimental group demonstrated significantly greater improvement on standard pen and paper assessments of UNS and decreased length of stay prior to discharge to home. Though this was a smaller study that

excluded patients with the dual diagnosis of UNS and homonymous hemianopsia, the results are pertinent for my patient as the average length of stay at the inpatient rehabilitation facility was only 10-14 days. A number of studies have shown patients with UNS have high rates of home discharge after 50-60 days of therapy,[12,14,33] however this study decreased average length of stay by 28 days while maintaining a 60% rate of home discharge which was comparable with the 65% rate of home discharge for patients recovering from stroke without UNS.

Wiart et al., 1997 explored the benefits of voluntary trunk rotation guided by visual scanning as measured by standard paper and pen assessments of neglect and the FIM in the subacute and chronic phases of stroke.[38] In the first study, 22 patients who averaged 30-35 days post stroke, 15 of whom had visual field deficits and 11 of whom presented with sensory extinction, were randomized into either an experimental or control group using a randomization table. The 11 patients in the experimental group received 1 hour per day for 1 month of training using the Bon Saint Come device which is worn like a backpack and interacts with a smartboard through trunk rotation guided by visual scanning, essentially transforming the torso into a Wii game controller. The control group received 3-4 hours per day of "conventional physical therapy" for 1 month which was not described in further detail. In a second study, 5 patients who were at least 6 months post stroke and continued to present with neglect were selected to follow the experimental Bon Saint Come protocol for a parallel analysis.

After 30 days of treatment, both subacute and chronic experimental groups saw significantly greater improvements in spatial awareness and functional ability than the control group. The effects remained constant when reassessed at 60 days. Perhaps most impressively, approximately half of the patients in both subacute and chronic experimental groups demonstrated remission of neglect as tested by the standard paper and pen assessments while only 1 patient in the control group demonstrated remission of neglect. Strong arguments in

support of the Bon Saint Come method in rehabilitation of acute unilateral neglect include the subacute stage of recovery the intervention was tested in for the majority of test subjects, the large percentage of patients with both UNS and homonymous hemianopsia, and the demonstrable improvement in both functional outcomes and visuo-spatial symptoms. Considerations for the methodological quality of this study include small sample sizes and a "clearing" of neglect without a lack of behavioral assessment. Regardless, due to the aforementioned success of the program and patient applicability, this study led to the incorporation of engaging technology utilizing visual scanning and trunk rotation in the treatment plan.

Chapter 6

Outcomes

Table 4

Outcomes

OUTCOMES				
BODY FUNCTION OR STRUCTURE IMPAIRMENTS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Catherine Bergego Scale	27	9	18 points	Y[24]
ACTIVITY LIMITATIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met ? (Y/N)
Functional Independence Measure	Transfers: Min Ambulation: Min W/C mobility: Min Stairs: SPV 4 stairs R rail Comprehension: 3 Expression: 3 Social: 3 Problem solving: 2 Memory: 3 Total Motor = 60 Total Cog = 14 Total = 74	Transfers: Mod I Ambulation: SPV W/C mobility: Mod I Stairs: SPV 12 stairs B rails Comprehension: 4 Expression: 6 Social: 6 Problem solving: 4 Memory: 4 Total Motor = 85 Total Cog = 24 Total = 109	Motor = 25 Cog = 10 Total = 35	Y[27]
Dynamic Gait Index	Total = 8	Total = 17	9	Y[30]
PARTICIPATION RESTRICTIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Discharge location	Undecided – ALF or HH	Home with 24 hour SPV and HH	Y	Y
ALF = assistive living facility, Cog = cognitive, DC = discharge , HH = home health, Min=minimal, SPV=supervision				

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Discharge Statement:

The patient attended inpatient physical therapy for treatment of acute right posterior cerebral artery stroke for 15 individual sessions over 15 days. The patient received neuromuscular reeducation, task specific mobility training, durable medical equipment, a home

evaluation, family training, and a home exercise program. He was limited in IADLs due to impaired cognition and required 24 hr supervision. Over the course of therapy, the patient achieved goals related to UNS, stroke severity, functional ability, instability in gait, and level of independence. The patient was discharged home to 24 hour family supervision and home health for continued occupational and physical therapy with a referral for mental health.

DC G-Code with modifier:

G8979 mobility - CI (FIM 13% disabled)

Chapter 7

Discussion

The patient met all goals. He showed a dramatic decrease in UNS, going from a classification of severe neglect (27/30) to mild neglect (9/30) with a substantial decrease in collisions from 27 to 2 per 1 hour session with an increasing complexity of tasks and in a variety of environments. The patient met the MCIDs of the total, motor, and cognitive FIM score, indicating clinically important changes had been met at the functional activity level. The patient met the DGI cut off score of 16, demonstrating decreased fall risk. After 15 days of therapy, the patient met his specific goal of discharge to home.

Studies of patients with UNS demonstrate significant improvement, but typically after lengths of stay of 1 to 3 months.[12,14,33] The patient exceeded expectations with such drastic improvements and a home discharge in only 15 days, despite challenges with inattention and agitation that were not addressed in the physical therapy plan of care. During the first 4 therapy sessions, the patient was unable to tolerate more than 45 minutes before falling asleep and being unarousable, responsive only to sternal rub. The patient was known to refuse planned exercises, fall asleep when bored, wander away if left unattended, use socially inappropriate language, and make negative or accusatory pronouncements about hospital staff.

I felt we made great progress by ensuring our interventions were meaningful to the patient. Any time I asked him to do a task in physical therapy, I would explain how this task would help him get closer to his goals of going home, getting back on the golf course, and visiting his family. He was very compliant with repeated FIM testing once he understood the FIM contributed to the therapy team's decisions related to discharge destination. Making the interventions meaningful in this way not only decreased the patient's agitation, there is evidence

that it also may have played a role in his dramatic recovery, and it is a technique I will continue to employ.[9]

I hope to see more research on unilateral neglect diagnostic testing psychometrics as this area currently lacks appropriate psychometrics. There is no gold standard test, no established specificities, no ability to calculate statistics such as likelihood ratios or positive predictive values.[8] There is, however, evidence of patients who have been "cleared" of neglect by the standard battery of paper and pen tests, only to test positive in ecological settings with the CBS, under pressure with a timed test, or in a more complex virtual reality environment.[24,36] This begs the question of whether we can validly diagnose subtle cases of neglect and whether it may best serve the patient to rethink neglect testing to include more real life stressors.

Differentiating homonymous hemianopia from unilateral neglect or confirming the presence of both is another area of limited evidence. After this patient was discharged, Nyffeler et al.,[42] published a study on the effectiveness of contralesional trunk rotation in discriminating real and pseudo-visual field deficits when testing visual fields via visual confrontation as well as Goldmann perimetry (a test which asks the subject to track a bright light across a white bowl to measure the entire visual field). The trunk rotation made a significant difference in the results of both visual confrontation and Goldmann perimetry testing for all participants with UNS, but no difference for the control patients. The difference, however, was largely related to central clearing. All of the patients with UNS and homonymous hemianopia or UNS and quadrantanopia still exhibited some amount of visual field deficit, ranging from minimally to greatly reduced via central clearing or a shift from hemianopia to quadrantanopia, following the trunk rotation. These results support the effectiveness of the technique and I look forward to utilizing trunk rotation with visual confrontation testing in the future.

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