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Functional Mobility For An Elderly Patient With Amyotrophic Lateral Sclerosis: A Case Report

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The patient signed a consent form to approve the use of her medical information, and recording images and voice for this case report.

The HIPPA privacy policy was reviewed and followed in regards to disclosure of PHI.

Key Words: Fall Risk, Amyotrophic Lateral Sclerosis, Physical Therapy

ABSTRACT

Background and Purpose: This case report provides a detailed description of how balance training was incorporated into physical therapy (PT) treatment to reduce fall risk and maintain functional mobility in an elderly patient diagnosed with ALS. Due to lack of research on ALS, and the terminal nature of the disease, clinicians and researchers may benefit from a palliative care PT plan to maintain functional mobility for patients with neurodegenerative diseases.

Case Description: An 82-year old female presented to outpatient PT with the diagnosis of ALS, with decreased functional mobility, high fall risk, and left hip/knee pain due to arthritis. She received 13 sessions over 12 weeks. The outcome measures used include the Berg Balance Score (BBS), Timed Up and Go (TUG) in seconds (s), 6 Minute Walk Test (6MWT) in meters (m), and manual muscle testing (MMT).

Outcomes: Balance training was used throughout the sessions to decrease fall risk, as well as therapeutic exercise to maintain strength for activities of daily living (ADL). Throughout treatment, she demonstrated slight decline in function, but was able to maintain function within the minimal clinically important difference (MCID). Maintenance of function was shown by the 6MWT (120 m to 126m) where distance was still within the MCID, and the TUG (23.75 s to 29 s) showed continued independence in transfers. Only slight decline in strength was shown in left dorsiflexion (4 to 3+/5) and in balance on the BBS (37 to 29/56).

Discussion: PT serves an important role in palliative care for the maintenance of function in neurodegenerative diseases and further research is needed to determine beneficial interventions.

INTRODUCTION/BACKGROUND and PURPOSE

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that affects the motor neurons within the corticospinal tract, brain stem, spinal cord, and primary motor cortex.[1] Disease progression can occur with an initial *bulbar* or *limb* onset showing signs

of weakness, spasticity, paralysis, and abnormal reflexes, presenting with either upper motor neuron or lower motor neuron dysfunction.[1] *Bulbar* onset refers to the medulla oblongata and pons which control the bulbar muscles of the face, jaw, soft palate, larynx, pharynx, and tongue.[2] With an initial onset of bulbar presentation, the patient demonstrates oral motor dysfunction including dysarthria, dysphagia, and sialorrhoea.[1] In *limb* onset, muscle atrophy as well as muscle fasciculation is common and typically presents around the age of 60.[1] As the course of ALS continues, it can lead to respiratory and pulmonary complications.[1] In 2014, five people per 100,000 people, with most incidence in males, were living with ALS in the United States (US).[1,3] With ALS being a fatal disease, the mortality rate, in the US was 1.84 per 100,000 people in 2009.[1] ALS is typically diagnosed when other neurodegenerative disorders are ruled out.[1] A recent awareness campaign that began in 2014, known as the "Ice Bucket Challenge", has increased public awareness and charitable funding for ALS, and highlighted the need for further research is needed to determine appropriate plans of care for medical treatment and rehabilitation.[4,5]

Due to the rapid disease progression and complete motor loss, the care for patients who have ALS requires a multidisciplinary approach.[1] Physical therapy (PT) plays a role in treatment of patients with ALS to focus on maintaining independence and functional mobility for as long as possible. Recommendations for treatment include gait training, strengthening, balance training, energy conservation education, prescribing braces, and assistive device training. For the early stage of ALS, the focus of PT is to assess fall risk and the need for adaptive equipment, as well as exercise focusing on strength, range of motion (ROM) within the lower extremities (LE), balance, and aerobic exercise.[5] In middle stage ALS, PT is used for assessing the use of assistive devices and wheelchairs, as well as education on transfers.[5] Advanced stages of ALS require palliative care and hospice, including caregiver education and monitoring to prevent skin break

down and contractures.[5] The importance of rehabilitation is to promote independence and improve quality of life as much as possible across the continuum of the disease progression.

Patients with ALS, as well as older patients with arthritis, are at risk for falling with a decrease in strength and balance during activity.[5,6] It was shown that balance training can improve static, dynamic, proactive, and reactive balance to reduce fall risk.[7] Balance training, including use of perturbation, can improve dynamic stability and LE strengthening.[8] Not only balance training, but also core stabilization exercises have shown to help improve balance, gait, and ADL's.[9] Other case reports have also demonstrated single-task and dual-task balance training being used to work on decreasing risk of falls.[10] The purpose of this case report was to describe balance training and reducing fall risk in a patient who had been diagnosed with ALS.

Patient History and Systems Review

The patient gave written consent for this case report to participate in a program working on balance deficits to decrease her high fall risk along with her plan of care. She was a pleasant 82-year-old female who began physical therapy (PT) one year prior to the episode of care (EOC) documented in this case report, with the diagnosis of ALS who presented with bulbar onset (ALS). Over the next winter, the patient went to Florida where she received PT services at home twice a week. One year after her initial diagnosis, she returned to the clinic with a referral by her primary care physician (PCP) which consisted of the diagnosis of ALS, decreased functional mobility, high fall risk, and left hip/knee pain due to osteoarthritis.

The patient's primary complaint was weakness in the LE, especially in the left hip secondary to osteoarthritis. Her goal for PT was to maintain her strength and balance to preserve functional mobility and independence. She was very open to physical therapy care and represented strong will and hard work. Because of the disease progression, her treatment required a team approach which included other services such as Occupational Therapy (OT) and Speech Therapy (SLP).

Previous PT treatment focused on improving walking tolerance, gait, balance, and functional strengthening with stairs and squatting.

Challenges that the patient faced included stairs, (static/dynamic/sitting/standing) balance, dysarthria, dropping things, and dysphagia. Her husband assisted her at home with cooking and driving. At the time of the initial evaluation, the patient was independent with bed mobility, toileting, showering, and laundry. The patient ambulated with a rollator and was able to tolerate walking within the community. Her past medical history included an initial onset of symptoms with slurred speech and weakness when she was first diagnosed with ALS, as well as osteoarthritis in her left hip. She was a very pleasant and resilient person who worked hard to maintain her function and independence for as long as possible. See Table 1 for Systems Review results.

Examination – Tests and Measures

The patient presented to the clinic with muscle weakness and balance deficits due to her diagnosis of ALS and left hip/knee osteoarthritis. Please see results of tests and measures in Table 2-3. Manual Muscle Testing (MMT) was used to determine the strength of her LE muscle groups into hip flexion, abduction, adduction, extension, knee flexion and extension, and ankle dorsiflexion as described by Youdas, et al.[11] MMT is reported to have excellent test- retest reliability, as well as a specificity of 0.90 and sensitivity of 0.35 for patients with hip osteoarthritis. MMT revealed weakness in bilateral LE.

Multiple measures were used to assess her fall risk. The first measure used was the Berg Balance Scale (BBS). The BBS uses functional items with a rating where the greater rating of four points per item indicates good balance.[12] This tool was found to have high reliability, with an interrater reliability of 0.97 and intrarater reliability of 0.98.[12] The BBS is reported to have a sensitivity of 91% and a specificity of 82% and with a score of less than 42 being predictive of

falls.[13] The patient's score on the BBS was 37/56 which put her at a risk of falling.

The Timed Up and Go (TUG) test, which consists of standing, walking three meters, and returning to the chair to sit, was also used.[14] The TUG shows a specificity of 87% and sensitivity of 87% in determining fall risk of older adults.[15] The cut off score for this test is less than 14 seconds (s) to complete the test indicated a high fall risk.[15] According to a study by Steffen, Hacker, and Mollinger, the TUG has high interrater and intrarater reliability with testing.[14] The patient was able to complete the TUG in 23.71s, indicating a high fall risk.

The 6 Minute Walk Test (6MWT) was used to aerobic capacity and endurance by measuring the distance walked over six minutes.[16] The 6MWT was proven to have good test-retest reliability.[15] Due to respiratory problems that arise with progression of ALS, the 6MWT was done to monitor respiratory endurance with activity.[16] Before the test was performed, the patient had a peripheral capillary oxygen saturation (SpO2) of 91% and a heart rate of 68 beats per minute (bpm). After walking 128.016 meters (m) for 6 minutes (min), the patient had an SpO2 of 92% and increased heart rate of 90 bpm.

Due to her reports pain in her left hip, the Numeric Pain Rating Scale (NPRS) was used with a range of 0 (no pain) to 10 (the worst pain).[17] The NPRS was proven to have excellent test-retest reliability and excellent internal consistency.[17] She reported her worst pain as a 4/10 on the NPRS. The patient's ROM for bilateral LE was within functional limits when grossly assessed. Other observations, such as gait and postural assessment, were made during the initial evaluation to determine treatment for functional strengthening and balance exercises. The patient used a rollator as an assistive device and her gait mechanics presented with a Trendelenburg sign due to right gluteus medius weakness, hyperextension in the knee, genu varus, foot slap, and foot eversion on the left. She was able to stand on her right LE for a single limb stance with bilateral upper extremity support for three seconds, but was unable to stand on her left. She could tolerate

standing 45 seconds with eyes closed, feet together, and without upper extremity support. She was also able to stand for two minutes unsupported with eyes open with supervision.

Clinical Impression: Evaluation, Diagnosis, Prognosis

Drawing conclusions from the examination, the patient showed decreased muscle strength in the bilateral LE, balance deficits, and impaired ambulation and stairs. Given these deficits, she was appropriate for PT for strengthening, balance training, and improving functional mobility. The patient's medical diagnosis was ALS and her PT diagnoses were high fall risk, decreased functional mobility, and left hip/knee pain.

Due to the disease progression of ALS being fatal, there was a poor medical prognosis; however, PT was focused on the goal of maintaining current function with strengthening and decreasing the patient's fall risk from loss of balance. Education was provided to the patient and caregiver regarding the disease progression and the role of PT. Research showed that the progression of ALS can cause respiratory problems that lead to death three-five years after a person was diagnosed.[5] The need for PT with this disease was to help promote and maintain respiratory/cardiopulmonary health through exercise for as long as possible, as well as functional mobility and strength.

Along with PT, the patient was also referred for other rehabilitation services. SLP worked on oral motor weakness and problems with dysarthria, and OT worked on energy conservation techniques, grip strength, manual dexterity, and upper extremity active ROM. The patient was evaluated at the initial evaluation in this EOC and at the final follow up after 12 weeks. The focus of this case report was the balance training component used to decrease the patient's high fall risk which included static, dynamic, proactive, anticipatory, and reactive balance training with functional activity. She was seen one to two times weekly and was given a home exercise program (HEP) to continue as tolerated so long as she was not overly fatigued.

She also performed strengthening exercises to address those deficits for maintenance of functional mobility. See Table 4 for the patient's goals.

Intervention and Plan of Care

The patient received PT services 1-2 times weekly, and OT/SLP services once a week. PT and OT were in regular communication about the patient's progress and how she was able to tolerate each session. The patient went to the rehab clinic for OT services with PT afterward, in the same visit, and followed up with an additional PT session later on in the week. A home evaluation was done with input from rehab to make suggestions to decrease her fall risk. These recommendations were motion-sensor lighting, cordless phones/cellphone, durable medical equipment (raised toilet seat/shower chair), shoes with slip resistant soles, grab bars within the shower and toilet area, and non-skid strips on the step going into her home.

Documentation was done on CPSI ClientWare (Mobile, AL) software. Daily notes were written each session to monitor progress, exercises performed, and it included an assessment on how the patient was able to tolerate exercise as well as explaining PT intervention. Every tenth session, a re-evaluation was completed and sent to her PCP.

She reported not following her home exercise program regularly due to fatigue and time constraints. She was very compliant in attending PT sessions and only missed one session due to fatigue. For treatment session ten, exercises and repetitions were scaled back due to her reports of increased tiredness, as well as an observed slower pace and difficulty with performing exercise. The patient's exercise program was progressed based on her tolerance for activity during each session.

With PT's main focus being on strengthening and balance training, a gait belt was used and exercises were performed in parallel bars for safety and close guarding. To decrease the patient's fall risk, balance training incorporated different types of balance control including steady-state,

proactive/anticipatory, and reactive. Evidence has shown that balance training is recommended to reduce fall risk in older adults.[7] This intervention was used for postural alignment and control, adaption to different tasks and environments, the use of multiple sensory systems to maintain balance, and improve safety when the patient was at risk of falling.[18] Please see Table 5-6 for interventions.

Static balance control was defined by O'Sullivan, Schmitz, and Fulk as "the ability to maintain stability and orientation with the center of mass over the base of support with the body at rest."[18 (pp275)] This was practiced in standing to promote standing endurance and balance with activities with a narrower and functional base of support. Static challenges also included standing with a narrow base of support and with eyes closed to decrease sensory input and without upper extremity support in the parallel bars.[17] The patient used the mirror when her eyes were open to maintain correct posture during exercises.

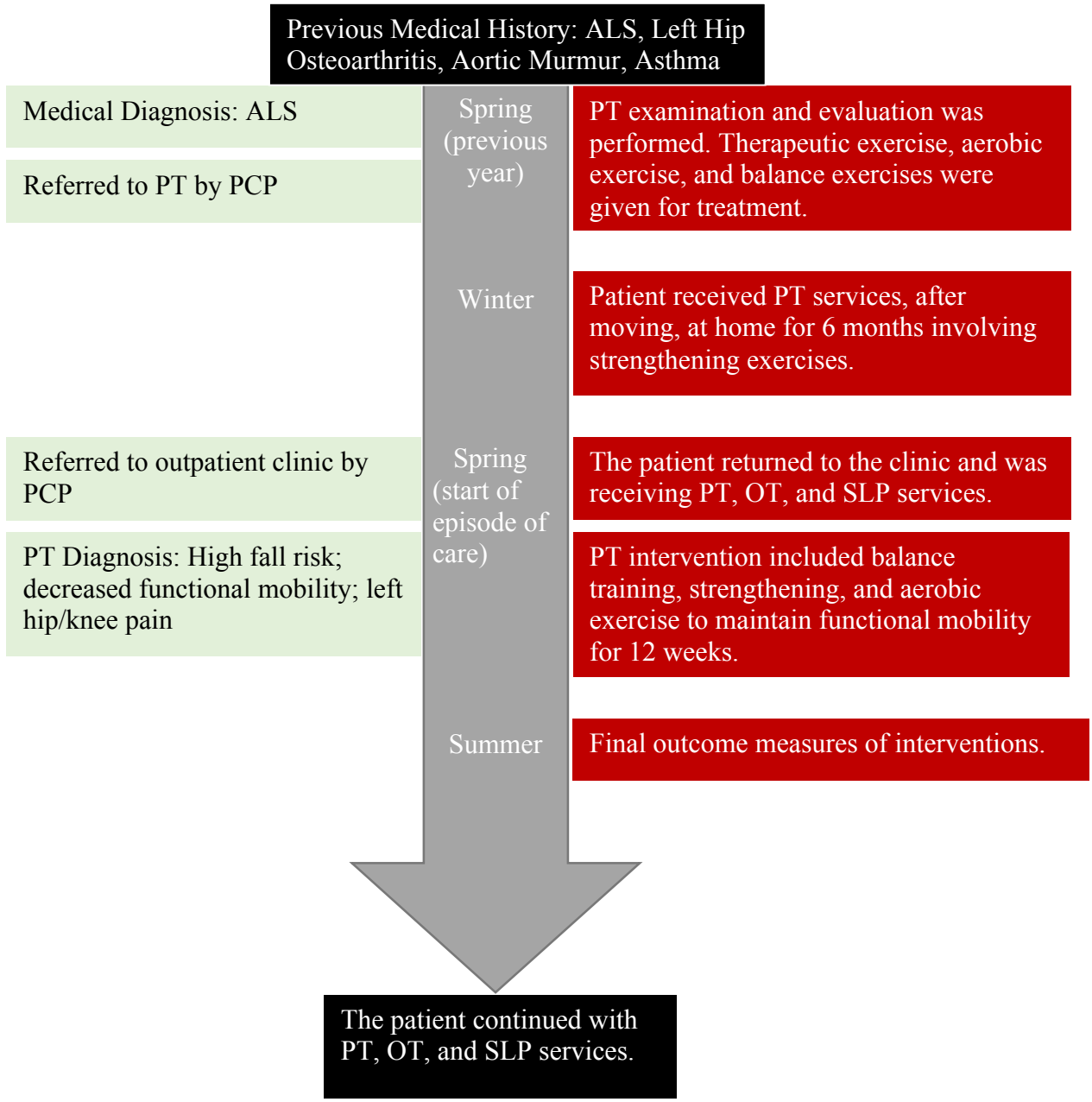
Dynamic/proactive postural control is referred to as maintaining the center of mass within the base of support and not fall outside of the limits of stability while moving the body.[18] Both seated and standing balance exercises were done to allow the patient to rest as to control her fatigue throughout the session. During this type of balance training, the patient was told what the activity was so she could initiate proper postural control in order to perform the action.[16] She required some support of her upper extremities to perform transfers, as well as using the parallel bars during exercises that required her to stand on a single limb, with a mirror being used for postural cueing.

Reactive balance is used as a reactive strategy to an unsuspected perturbation that results in compensatory motion at the hip, ankle, and stepping.[18] We focused on improving reactive balance strategies, as they are important when an unsuspecting perturbation may cause a fall.[8]

Perturbations were used in the patient's plan of care, without upper extremity support, to challenge reactive balance and train her LE muscles to respond.

The patient's program began with strengthening exercises that would also challenge static and dynamic balance. She was educated on a home exercise program that consisted of: standing with eyes open and feet together, balancing without upper extremity support 4x15 seconds; toe taps on step alternating 2x10 repetitions; heel raise to toe lift 2x10 repetitions; and reaching at her counter for a cup and placing it back in the same spot while standing for 2x10 repetitions. Due to fatigue that occurs with the disease progression, she was instructed to perform the exercises separately throughout the day and to avoid doing exercises on days of increased fatigue to save energy for daily activities.

TIMELINE


Previous Medical History: ALS, Left Hip Osteoarthritis, Aortic Murmur, Asthma
Medical Diagnosis: ALS
Referred to PT by PCP
Spring (previous year)
PT examination and evaluation was performed. Therapeutic exercise, aerobic exercise, and balance exercises were given for treatment.
Winter
Patient received PT services, after moving, at home for 6 months involving strengthening exercises.
Referred to outpatient clinic by PCP
PT Diagnosis: High fall risk; decreased functional mobility; left hip/knee pain
Spring (start of episode of care)
The patient returned to the clinic and was receiving PT, OT, and SLP services.
PT intervention included balance training, strengthening, and aerobic exercise to maintain functional mobility for 12 weeks.
Summer
Final outcome measures of interventions.
The patient continued with PT, OT, and SLP services.

OUTCOMES

The patient received 13 PT sessions over 12 weeks. Balance training was utilized throughout the sessions to decrease fall risk, as well as therapeutic exercise to maintain strength for ADL's. The patient performed aerobic exercise at each session to maintain cardiopulmonary health and to increase LE strengthening. The patient was assessed at the beginning of care and after 12 weeks of the interventions. Throughout treatment, she demonstrated slight decline in function, but was able to maintain function within the minimal clinically important difference (MCID). Maintenance of function was shown by the 6MWT (120 m to 126 m) where distance was still within the MCID, and the TUG (23.75 s to 29 s) showed that she was independent in transfers.[25,26] Only slight decrease in strength was shown in left dorsiflexion (4 to 3+/5) and in balance on the BBS (37 to 29/56). See Table 2-3 for final follow up results.

As mentioned previously in the interventions, the patient was very compliant with attending PT sessions, however, fatigue was a barrier to exercise prescription. See Table 5-6 to see exercise progressions. Intervention tolerance was monitored subjectively throughout the sessions and followed up with at the next session to assess how the patient felt after the previous appointment. There were no adverse events during this EOC.

DISCUSSION

In this case report, balance training and therapeutic exercise demonstrated the potential for maintaining function in a patient on palliative care. This patient presented between early to middle stage ALS. Over the course of treatment, as documented in previous literature, fall risk assessment was performed and the exercise program focused on strength, balance, and aerobic exercise.[5] Recommendations were given to decrease fall risk in the home and the patient was educated on sit to stand transfers. Although her balance did not improve according to the BBS

and TUG, the patient did not report any falls during this EOC. She maintained the majority of her strength as measured by MMT, as well as cardiovascular function in the 6MWT over the 12 weeks.

Because of the progression of the disease, one strong component in this EOC was education to help maintain mobility. She was educated on safety in the community, as well as in her activities at home to help decrease her risk of falling. This, along with her exercises, are ways that PT can provide care to those with ALS. Limitations to this intervention included the decrease in activity tolerance and increase in fatigue. The balance of activity tolerance and fatigability was difficult to maintain in prescribing exercises to improve functional mobility. This case report describes only a small window of time for the interventions, not allowing long term results to be seen in her outcomes. Within the 13 sessions, the patient was able to meet some of her goals including maintaining balance in sitting or standing for two minutes (min) unsupported, denying an increase in pain greater than 4/10, and maintaining her LE ROM within functional limits.

Research is needed to find the best interventions for maintaining functional mobility and balance in patients with ALS, as well as dosage recommendations. In 2018, The American Physical Therapy Association (APTA) House of Delegates approved motion 46-18 *Charge: Eliminating the Improvement Standard for Receiving Physical Therapy,* which supports PT services for hospice and palliative care in the maintenance of function.[9] This public policy charge to the APTA has the potential to allow future practitioners to help patients, such as this, with support for reimbursement of care due to degenerative diseases. Functional decline in the presence of a progressive neurodegenerative disorder was anticipated; however, treatment was primarily focused on maintaining functional mobility and decreasing fall risk. This case illustrates how PT services can be utilized by continuing to promote functional independence

with terminal diseases.

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TABLES and FIGURES (Max of six total)

Table 1. Systems Review

Systems Review	
Cardiovascular/Pulmonary	The patient has previous history of an aortic murmur and asthma.
Musculoskeletal	Dupuytren's Disease both hands, Lumbar vertebrae 3-5 spinal stenosis, left hip arthritis
Neuromuscular	ALS resulting in bilateral LE and UE weakness, and dysarthria.
Integumentary	The patient denied sensation alterations and integumentary system is intact.
Communication	The patient presents with dysarthria due to bulbar symptoms from the ALS. When communication is difficult, she uses a tablet to write down her responses.
Affect, Cognition, Language, Learning Style	She is a pleasant female who shows resilience and is determined to maintain current function for as long as possible. Her learning style consists of visual, auditory, and hands on. She was alert and oriented to person, place, time, and situation. The patient communicates in English.
Medications	Albuterol: Bronchodilator[19] ; Singulair: Asthma[20] ; Pravastatin: Hypercholesterolemia[22] ; Synthroid: Hypothyroidism[23]

Table 1. LE= lower extremity; UE= upper extremity

Table 2. Tests & Measures

Tests & Measures	**Initial Evaluation Results**			**Final Follow Up Results**		
TUG	23.75 s			29 s		
Berg Balance	37/56			29/56		
6 Minute Walk Test (6MWT)	420 feet =128.02 meters	Pre-Test	Post –Test	412 feet =125.58 meters	Pre-Test	Post-Test
	Oxygen Saturation	91%	92%	Oxygen Saturation	93%	94%
	Heart Rate	68 bpm	90 bpm	Oxygen Saturation	78 bpm	98 bpm

Table 2. s= seconds; bpm= beats per minute

Table 3. Lower Extremity Strength Testing

	Left		**Right**	
	Initial Evaluation	**Final Follow Up**	**Initial Evaluation**	**Final Follow Up**
Hip Flexion	4-/5	4-/5	4/5	4/5
Hip Abduction	5/5	5/5	5/5	5/5
Hip Adduction	5/5	5/5	5/5	5/5

Knee Flexion	4/5	4/5	4+/5	4+/5
Knee Extension	4/5	4/5	4+/5	4+/5
Dorsiflexion	4-/5	3+/5	4+/5	4+/5

Table 3. MMT is measured on scale from 0-5, where 0 is no trace of muscle contraction and 5 is normal.[24] As measured from this data, 4-/5 showed that the patient was able to hold the position while the tester gave slight to moderate force with testing, 4/5 is against a moderate force, and a 4+/5 is against a strong force.[24]

Table 4. Physical Therapy Goals

Short Term Goals	**Long Term Goals**
The patient will be independent and compliant with a home exercise program outside of the clinic to assist with strength, gait, and mobility in 10 visits. **Goal Not Met**	Patient will present with ambulation distance of at least 420 feet signifying no regression in gait tolerance in 20 visits. **Goal Met**
The patient will maintain her Berg Balance score to signify maintaining function with gait and activities of daily living in 10 visits. **Goal Not Met**	The patient will increase Berg Balance Test by an additional 1-2 points signifying less fall risk in 20 visits. **Goal Not Met**
The patient will deny an increase in pain higher than 4/10 as to not increase pain with therapy in 10 visits. **Goal Met**	The patient will be able to maintain her lower extremity range of motion within functional limits to allow ease with activities of daily living and ambulation in 20 visits. **Goal Met**
The patient will decrease her Timed Up and Go score from 23.75 seconds to 20 seconds to show a decrease in her fall risk in 10 visits. **Goal Not Met**	The patient will be able to maintain balance with standing and sitting unsupported for 2 min to decrease fall risk with reaching for objects in 20 visits. **Goal Met**

Table 5. Interventions (Sessions 1-8)

	Session	1	2	3	4	5	6	7	8
Aerobic Exercise	Nu Step (Ann Arbor, MI)	10 min	10 min	10 min	10 min	10 min	10 min	10min	10 min
Static Steady State Balance									
	Eyes Open Feet Together Unsupported						3x 20 s		
	Eyes Closed Feet Apart Unsupported						3x 15 s	3x 15 s	
Proactive /Dynamic Balance									
	Sit to Stand	2x5 reps	2x5 reps	2x5 reps	3x5 reps	3x5 reps	3x5 reps	3x5 reps	3x5 reps
	Seated March	2x 10 reps	2x10 reps	2x10 reps				2x15 reps	
	Mini Squat		2x10 reps	2x10 reps	3x10 reps	3x10 reps			

	Standing Hip Abduction		2x10 reps	2x10 reps	2x10 reps	2x10 reps			
	Standing Hip Extension			2x10 reps	2x10 reps	2x10 reps			
	Calf Raise	2x10 reps	3x10 reps	3x10 reps	3x10 reps	3x10 reps			3x10 reps
	Standing Knee Flexion			2x5 Bilateral reps					
	Seated Knee Flexion				2x10 reps				
	Step Taps Bilaterally						4" 3x10 reps	6" 10x	
	Standing Reach Bilaterally						2x10 reps		
	Standing Marches								3x10 reps
	Step Ups								6" 10x
Reactive Balance									
	Calf Raise to Toe Lift						2x10 reps	2x10 reps	
	Eyes Open Feet Together Perturbation							3x15 s	

404 Table 5. reps= repetitions; s= seconds

405 **Table 6.** Interventions (continued) Sessions 9-13

	Session	9	10	11	12	13
Aerobic Exercise	NuStep (Ann Arbor, MI)	10 min	10 min	10 min	10 min	10 min
Static Steady State Balance						
	Eyes Open Feet Together Unsupported	2 min				
	Seated Eyes Open	2 min				
	Eyes Closed Feet Together Unsupported	3x 20 s	4x 20 s	3x 35 s	3x 45 s	3x 45 s
Proactive /Dynamic Balance						
	Sit to Stand	3x5 reps	2x5 reps	2x5 reps	3x5 reps	3x5 reps
	Seated March		3x10 reps			2x10 reps
	Calf Raise		3x10 reps		2x10 reps	2x10 reps
	Standing Reach Bilaterally		15x Bilateral		15x Bilateral	15x Bilateral
	Standing Marches			2x10 reps		

	Single Limb Stance/Kick		12x Bilateral			
	Narrow Walk		4x30 steps			
	Tandem walking			35 steps	40 steps	40 steps
Reactive Balance						
	Eyes Open Feet Together Perturbation		3x 15 s	3x 20 s	3x 20 s	

406 Table 6. min=minutes; reps= repetitions; s= seconds

407 **CARE Checklist**

CARE Content Area	Page
1. **Title** – The area of focus and "case report" should appear in the title	1
2. **Key Words** – Two to five key words that identify topics in this case report	1
3. **Abstract** – (structure or unstructured) a. Introduction – What is unique and why is it important? b. The patient's main concerns and important clinical findings. c. The main diagnoses, interventions, and outcomes. d. Conclusion—What are one or more "take-away" lessons?	2
4. **Introduction** – Briefly summarize why this case is unique with medical literature references.	2-4
5. **Patient Information** a. De-identified demographic and other patient information. b. Main concerns and symptoms of the patient. c. Medical, family, and psychosocial history including genetic information. d. Relevant past interventions and their outcomes.	4-5
6. **Clinical Findings** – Relevant physical examination (PE) and other clinical findings	5-8
7. **Timeline** – Relevant data from this episode of care organized as a timeline (figure or table).	11
8. **Diagnostic Assessment** a. Diagnostic methods (PE, laboratory testing, imaging, surveys). b. Diagnostic challenges. c. Diagnostic reasoning including differential diagnosis. d. Prognostic characteristics when applicable.	7-8
9. **Therapeutic Intervention** a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	8-10
10. **Follow-up and Outcomes** a. Clinician and patient-assessed outcomes when appropriate. b. Important follow-up diagnostic and other test results. c. Intervention adherence and tolerability (how was this assessed)?	12

408

d. Adverse and unanticipated events.	
11. **Discussion** a. Strengths and limitations in your approach to this case. b. Discussion of the relevant medical literature. c. The rationale for your conclusions. d. The primary "take-away" lessons from this case report.	12
12. **Patient Perspective** – The patient can share their perspective on their case.	4-5
13. **Informed Consent** – The patient should give informed consent.	4

409