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Regaining Independence In Ambulation For A Visually Impaired Patient With Rhabdomyolysis: A Case Report

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Key Words: Rhabdomyolysis, Legally Blind, Functional, Ambulation

ABSTRACT

Background and Purpose: Rhabdomyolysis is a myopathic condition that causes significant muscle wasting following an acute onset. This condition elevates creatine kinase in the bloodstream, and commonly causes the patient to have muscle pain, swelling, and weakness, as well as dark "tea" colored urine. The purpose of this study was to describe physical therapy (PT) interventions used treating a legally blind (LB) elderly male with rhabdomyolysis and multiple comorbidities.

Case Description: A 78-year-old male referred to PT with a diagnosis of rhabdomyolysis following a fall in the home. He presented with muscle soreness, decreased lower extremity (LE) strength, and impaired functional mobility. Interventions included LE strengthening, transfer training, gait training on all surfaces, education on symptom management, and modification of assistive devices. Outcomes included the Missouri Alliance for Health Care assessment for fall risk (MAHC-10) and the Performance Oriented Mobility Assessment (POMA).

Outcomes: The MAHC-10 remained at 6/10 for fall risk. The patient's POMA was not formally assessed until discharge, where he scored 16/28, falling below the cutoff score of 19 for fall risk. The patient's LE strength had no significant change except improved ankle strength.

Discussion: The proposed interventions appeared to have some benefit for the patient in increasing LE strength and independence with functional mobility. Further research is needed on interventions to improve strength and functional mobility in elderly patients with rhabdomyolysis as existing literature is limited.

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INTRODUCTION/BACKGROUND and PURPOSE

Rhabdomyolysis is a myopathic condition with an acute onset that causes a rapid degradation of muscle tissue.[1,2] What differentiates it from other myopathies is a significantly elevated release of creatine kinase (CK) a muscle enzyme that is a cellular component in healthy muscle tissue, into the blood stream.[1,3] A 2014 clinical review on exertional rhabdomyolysis (ER) in athletes reported an incidence of 29.9 per 100,000 patients years, however there is little evidence on the incidence or prevalence in the general population.[4]

No one cause is associated with the diagnosis of rhabdomyolysis. Some of the most common causes for adults include muscle trauma through injury or strenuous activity, drug and alcohol abuse, medications, toxins, infections, and extended periods of immobility.[1,5] Preexisting conditions that can predispose an individual to the condition include metabolic disorders, inherited myopathies, and muscular dystrophies.[2] Individuals with rhabdomyolysis have sustained damage to their ion channels, cascading into an excessive quantity of intracellular (Na^+) and calcium (Ca^+), as well as depletion of energy stores of adenosine triphosphate (ATP).[1] As a result, muscle fibers become inflamed and die, breaking down their components and spreading them throughout the bloodstream.[1] The hallmark signs and symptoms associated with rhabdomyolysis include muscle pain, swelling, and weakness, as well as a dark "tea-colored" urine.[1,2] With elevated levels of CK, many patients are susceptible to acute renal failure in the later stages of the condition if left untreated, and may need dialysis treatment.[1]

Though not much exists in the literature for treating cases of rhabdomyolysis in geriatric patients, some treatment info exists for ER in young adult athletes and military personnel.[4,6-8] Studies have indicated that educating on the importance of oral hydration and achieving eight hours of sleep a night led to successful outcomes, particularly in the first 72 hours after onset of

ER.[4,6-8] These studies also indicated that administering an upper extremity (UE) and lower extremity (LE) therapeutic exercise program targeting progressing from passive range of motion (PROM), to active range of motion (AROM), and then finally resistance training resulted in excellent prognoses for patients with ER.[6,7,8] For treating individuals who are legally blind (LB), the journal of Topics on Geriatric Rehabilitation[9] states that therapists should implement regular use of verbal cues, tactile cues, and supervision until the patient is familiar with surroundings. According to clinical practice guidelines on older adults with increased fall risk, treatments should be focused on screening for and treating balance impairments based on presentation.[10]

This case report was needed, as literature on physical therapy (PT) management of rhabdomyolysis following hospital care was extremely limited compared to literature on medical management and guidelines to prevent further decline. The purpose of this case report was to describe PT management for a homebound LB elderly male with rhabdomyolysis, who was looking to increase his independence in both the home and the community.

Patient History and Systems Review

The patient provided consent for this case report. The patient was a 78-year-old male referred to home health PT after a prior traumatic fall in his home. The suspected cause of the fall was a report of dizziness during the incident. The patient also had a preexisting infection in the prostate at the time of the incident, which could have been a potential cause of his medical diagnosis of rhabdomyolysis.[1,2,5] The patient's primary complaints were that he no longer felt safe walking beyond his driveway, and that he often felt weak, fatigued, and a bit shaky.

The patient's relevant medical history included the diagnoses of chronic obstructive pulmonary disease, osteoarthritis, Leber's hereditary optic neuropathy (LHON), hypertension (HTN), peripheral neuropathy, patellofemoral pain syndrome, and the recent diagnosis of

rhabdomyolysis. The patient was noted to be LB secondary to the diagnosis of LHON. His comorbidities were managed with a list of medications and supplements that were provided in his chart (Table 1). The patient was a nondrinker and former smoker. He was widowed and lived alone, except for one large dog. He also had a housekeeper who came into the home regularly, as well as a neighbor who checked on him periodically and helped with errands. He had previously received outpatient PT, but this was prior to decline in overall function. No new falls were reported since his initial incident.

The patient stated his goals for PT were to increase LE strength for safe ambulation, increase his endurance to allow him to work in his garden and ambulate in the community, and to gain confidence ambulating with the least restrictive assistive device (AD). His doctor recommended him using his four-wheel walker with a seat (4WW) as his primary means of ambulation, but he was using bilateral single point canes (SPC) as his primary means of ambulation within his home. At baseline, he used a white cane for sensory feedback and a SPC to ambulate in the community, though he could no longer use his white cane since he needed a 4WW for balance. The patient's home had both an upstairs and a basement. Though he was not currently negotiating a flight of stairs (FOS), his goal was to be able to negotiate both sets of stairs by discharge (DC). His bathroom with a shower was upstairs, but he used his downstairs bathroom and performed daily sponge bathes instead. The patient's upstairs bathroom and other parts of the home were outfitted with adaptive equipment, though his main floor had a lot of clutter that limited him from using his 4WW within the home. He spent most of his time in the living room on the main floor, which contained his bed and a chair he sat in regularly.

While performing the patient's systems review, he presented with impairments in multiple systems (refer to Table 2). His plan of care (POC) focused on safe ambulation strategies

for the home and the community, general strengthening and balance training to decrease risk of falls. The patient was a good candidate for a case report, as he was compliant to make any changes necessary to increase his independence.

Examination – Tests and Measures

During the initial evaluation (IE), tests were administered with an emphasis on screening the patient's, musculoskeletal and cardiopulmonary systems (Table 3). Manual Muscle Testing (MMT) was performed on bilateral LE with the patient in sitting, per the grading criteria of Kendall.[11] The patient's hip flexion and abduction were 4/5 on the left, or resistant to moderate pressure, and 4-/5 on the right, or resistant to slight to moderate pressure. His knee flexion and extension were 4/5 bilaterally, or resistant against moderate pressure. His bilateral plantarflexion and left dorsiflexion were 3+/5, or resistant against slight pressure, and his right dorsiflexion was 3/5, or able to hold test position without pressure. Patient also had decreased bilateral shoulder strength, but this component of care was being assessed and treated by home health occupational therapy (OT).

Bed mobility and transfers were assessed as part of the patient's functional mobility. The patient was able to perform all bed mobility with stand by assist (SBA) and sit to stand transfers with contact guard assist (CGA). The patient was asked to demonstrate how he ambulates on various surfaces with his AD of choice. He ambulated 100 feet on level ground inside his home with SBA with bilateral SPC, 50 feet on uneven ground in his driveway with minimal assistance and bilateral SPC, and 3 steps on stairs to his porch with minimal assistance (minA), one SPC, and the railing (Table 4).

The Missouri Alliance for Health Care assessment for fall risk[12] (MAHC-10) was administered at IE. The test is a 10-item checklist of items worth 1 point each that put a patient at

high fall risk, with a cutoff score of 4 or more items indicating the patient is a fall risk.[7] The patient scored a 6 for being age 65+, diagnosis (3 or more co-existing), visual impairment, impaired functional mobility, environmental hazards, and poly pharmacy (4 or more prescriptions – any type) putting him at risk. A 2012 validation study performed by Calys et al.[13] indicated that a cutoff score of 4 has 96.9% sensitivity, though only a specificity of 13.3%, which was predicted to improve if the cutoff score were increased to 6. The Performance Oriented Mobility Assessment (POMA), which is a 16-item gait and balance assessment scored out of 28 with scores below 19 indicating high fall risk was not formally assessed at the IE (Table 3), but was assessed at DC as a predictor of future fall risk.[14] Lin et al.[15] suggests this measure has superior test-retest reliability, discriminant validity, and predictive validity in populations over 65 years of age. Due to his history of HTN, the patient's resting pulse (RP) and blood pressure (BP) were assessed seated and at a rested state. His pulse was taken via radial palpation at the wrist, and his BP was taken using a manual BP cuff and stethoscope. His RP was 81 beats per minute, and his BP was 133/72 millimeters of mercury (mmHg).

Clinical Impression: Evaluation, Diagnosis, Prognosis

The patient presented with generalized muscle weakness, muscle soreness, and fatigue affecting his ability to safely ambulate in the community independently. His signs and symptoms were consistent with his primary diagnosis of rhabdomyolysis (ICD-10 code M62.82).[1,2,5] He also was given the physical therapy diagnosis of other abnormalities affecting gait and mobility (ICD-10 code R26.89). The impression of these diagnoses was further supported by the results of his LE MMT, his MAHC-10 score, his need for some level of assistance with transfers, and decreased steadiness with gait on all surfaces with gait abnormalities (Table 4). The patient continued to be an appropriate fit for a case report due to his work ethic and interest in

participation.

The patient's prognosis was good, as he was motivated to regain independence ambulating outside his home, and at baseline was familiar with the environments he wanted negotiate with low vision. Some barriers to treatment were limited information on evidence-based PT treatment for patients with rhabdomyolysis, as well as navigating the patient's use of a 4WW and a white cane to denote his LB status while still allowing for safe ambulation. Precautions for treatment included preventing dehydration, avoiding activities that promote joint stiffness and pain to the muscles, and monitoring for signs of deep vein thrombosis and other red flag health signs.[6]

The plan for visit frequency after IE was to see the patient twice a week for five weeks, then once a week for three weeks. During the DC visit, all tests and measures (Table 3) and functional mobility (Table 4) would be reassessed, as well as an additional POMA test to be used as a predictor of patient fall risk. The patient's RP was taken at the start of each visit. Interventions would include therapeutic exercises and a home exercise program (HEP) intended to increase LE strength and standing balance, transfer training, gait training, maintenance of adaptive equipment, and education as needed. See Table 5 for patient goals.

Intervention and Plan of Care

The patient received both PT and OT services on a bi-weekly basis, along with a weekly visit from a health care assistant for self-sanitization maintenance. The referring physician received correspondence from PT at the IE and at DC and were able to receive information on daily visits per request. Reconciliation of medications was completed at both IE and DC as well, which required checking in with the patient's primary care physician (PCP) to see if all medications were accurate and up to date. At the start of each daily visit, the patient was

interviewed for medication changes, current pain level, recent falls, and whether he had been to the hospital since last visit. Afterwards, his BP was taken in order to rule out any red flags for participation in activity for the day per protocol for home health. Interventions were determined both by clinical judgement and by patient preference.

During the first week of PT, the focus was on improving transfer mechanics, initiating gait training, and providing the patient with standing exercises sharing similarity to the Aura Health Care protocol[16] (Figure 1). Transfer mechanics improved quickly to SBA from CGA by changing foot placement, whereas gait abnormalities appeared to present from LE weakness, particularly in the hips. The hip flexors and extensors work opposite of each other during the swing and stance phases of gait, while hip abductors control the lateral tilt of the pelvis throughout the gait cycle.[17] Each of these gait components was addressed through exercises (Figure 1), as were deficits in knee and ankle strength.[16] The patient performed single leg stance for static balance in his HEP, as well as anterior to posterior (AP) and medial to lateral (ML) weight shifts to promote reactive stepping strategies in the AP and ML directions, respectively Table 6).[18]

In the second week, the patient complained of bilateral calf soreness, but admitted he performed more than the prescribed repetitions. This muscle soreness could also be the result of the physiological symptoms of rhabdomyolysis with exertion.[1,2,5] For treatment, the patient was educated on ankle exercises using a red TheraBand® (Performance Health, Chicago, Illinois) to promote lower leg strengthening, as well as a seated calf stretch with a nylon strap to loosen tight muscle tissue (Table 6). The patient was instructed to perform these in the morning, continue his standing HEP, hydrate properly, and take rest breaks as needed. Though the patient attempted stairs in both week one and two, the activity was discontinued for a later date due to need of

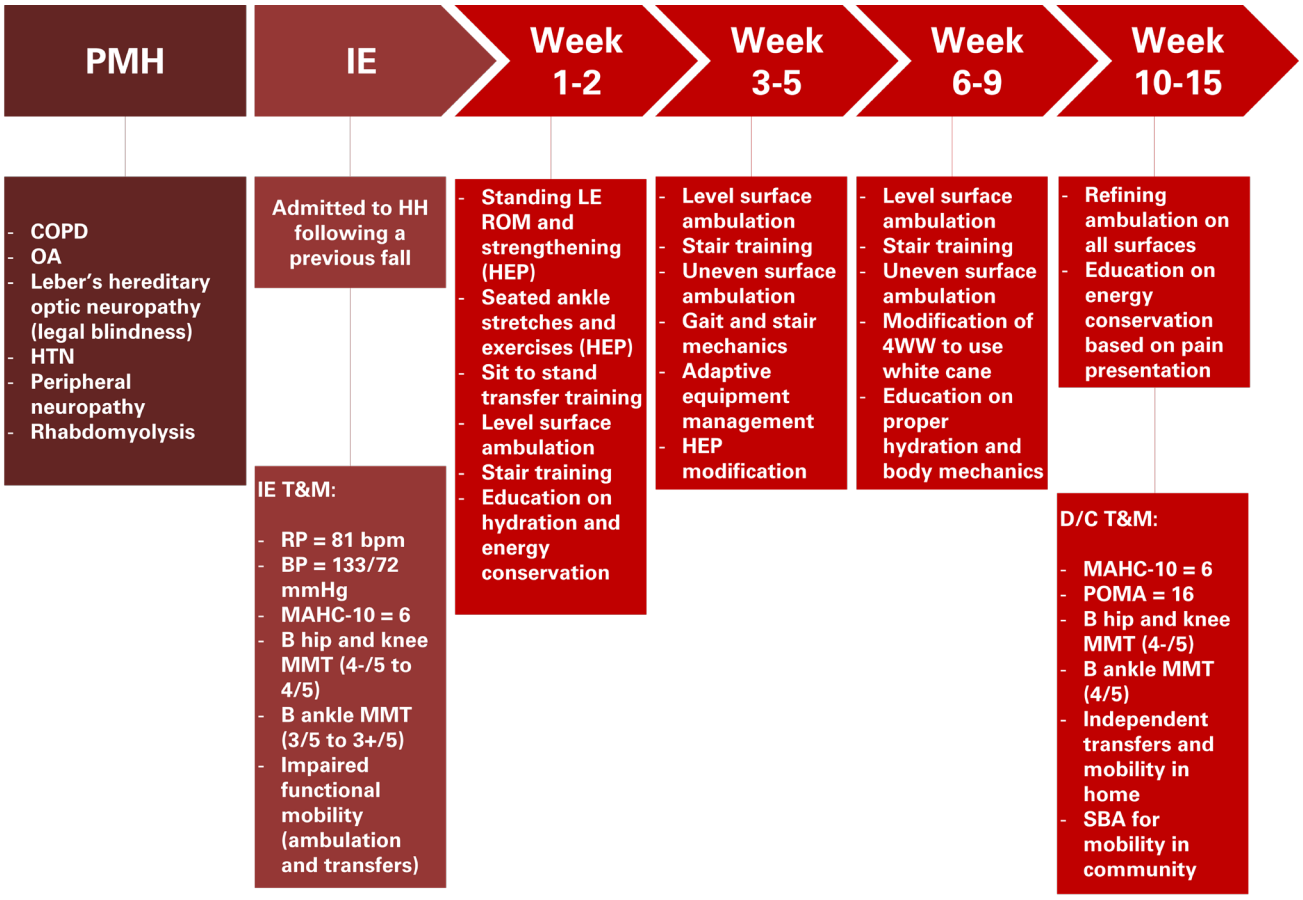
minA.

During weeks three through five, emphasis transitioned to increasing independence with sit to stand transfers and ambulation in the home. Gait training on outdoor surfaces and stair training were added to work towards his personal goals (Table 5), while also managing and adapting his 4WW for safe use (Table 6). A compromise was made for the patient to use bilateral SPC within his home, as using a 4WW in the home was cumbersome due to narrow walkways. The goal was to use the 4WW in the community, as it was the safest device to improve gait mechanics. With the 4WW he reciprocated gait and had far less sway than he did with the bilateral SPC. Due to frequent rest breaks, distance was added gradually for each bout of uneven gait training outdoors. With stair training, the patient used bilateral railings in the home for stability, leaving his canes at the base of the steps and having the PT place a spare walker at the top of the steps to allow for safe ambulation upstairs. The patient demonstrated a step-to pattern on the steps leading with his left foot, which appeared appropriate and safe. He required minA at first due to instability while ascending, but progressed to CGA, and eventually SBA. His verbal cue was to hike his right hip while stepping to compensate for his foot drop. Once he could safely ascend his 15-step FOS, a joint visit was arranged with OT during week five so he could perform a shower transfer and discontinue sponge bathing. As his independence was progressing to baseline within the home, the focus shifted to managing and adapting his 4WW for community ambulation. The objective was to make sure the 4WW height was appropriate to normalize gait, while also accommodating for use of his white cane as a tactile cue for awareness of surroundings. He could use his 4WW with CGA with no white cane, but without adaptation, he was more vulnerable to environmental hazards if attempting the task independently. The patient continued to perform his HEP with some complaint of leg soreness but stated that it was

diminished on days that he wasn't overzealous with exercise repetitions.

During weeks six through nine, the patient was cleared to ambulate stairs independently, shifting focus towards continuing to improve community ambulation. After difficulty finding an existing adaptation for a 4WW to outfit a white cane, an original design was made using brackets, small hardware, nylon cord, and rubber bands (Appendix 2). PT was continued for an additional six weeks following the case report to further address functional mobility issues and provide necessary education.

TIMELINE



Timeline: Past medical history (PMH), chronic obstructive pulmonary disease (COPD), osteoarthritis (OA), hypertension (HTN), initial evaluation (IE), tests and measures (T&M), resting heart rate (RP), beats per minute (bpm), blood pressure (BP), millimeters of mercury (mmHg), Missouri Alliance for Healthcare Fall Risk Assessment (MAHC-10), bilateral (B), manual muscle testing (MMT), lower extremity (LE), range of motion (ROM), home exercise program (HEP), four-wheel walker (4WW), discharge (D/C), Performance Oriented Mobility Assessment (POMA), stand by assistance (SBA).

OUTCOMES

Over the initial certification period of therapy, the patient made some increases in LE strength and functional mobility. After recertification, his progress gradually plateaued. Upon DC, the patient's gross bilateral LE MMT was relatively unchanged (4-/5, which was the same or less than IE). However, his gross ankle plantarflexion and dorsiflexion MMT increased from a range of 3/5 to 3+/5, to 4/5 bilaterally. His MAHC-10 was unchanged, remaining at 6/10. Though the POMA was only evaluated at DC, the patient scored <19 with a score of 16, putting him at increased fall risk (Table 3).[14].

The patient met his goals of independence with HEP, sit to stand transfers with no assistance, and negotiating a flight of stairs with the least restrictive device. He partially met his goal of ambulating 300 ft outside with the least restrictive device and did not meet his goal of achieving 4+/5 LE strength bilaterally. Goals and progress can be found in Table 5.

At DC, he agreed to continue his HEP as prescribed, seek assistance to clean walkways within the home, and to join a waiting list for private duty to receive part time in-home assistance. He also agreed to using a SPC or bilateral SPC in the home, and his 4WW in the community with SBA. The patient made plans to follow up with his PCP following DC, particularly to further address complaint of bilateral calf pain that had little remittance over the course of PT.

DISCUSSION

This case demonstrated PT management for a homebound LB elderly male with rhabdomyolysis looking to increase his independence. The POC consisted of education on precautions linked to the diagnosis of Rhabdomyolysis based on the available research,[4,6-8] along with interventions to increase LE strength and functional mobility using clinical judgement. Over

15 weeks of therapy, the patient improved his ankle strength bilaterally and overall functional mobility, permitting an increase in independence in the home and community.

One strength of this case report was that most goals were either met or partially met. Although bilateral gross LE MMT score of 4+/5 was not met, an increase to 4/5 bilateral ankle strength was noted. A potential reason for improvement in ankle strength may be the combination of standing exercises and seated isolated ankle exercises. The degradation of muscle tissue associated with rhabdomyolysis, along with the age of the patient may have contributed to the plateau of gross LE strength in the patient.[1,2]

A major limitation in this case report was that little was available for interventions to treat rhabdomyolysis, particularly in geriatric populations. What research was available targeted younger patients with ER, providing precautions and education for the patient, as well as general therapeutic exercise principles beginning with ROM and progressing to resistance exercises.[6,7,8] With this available information, therapeutic exercises were applied that included both elements of ROM and body weight resistance, with some balance components and stepping strategies added to decrease fall risk (Table 6). A limitation in using the MAHC-10 as a measure of progress was that many of the patient's factors were non modifiable, including age 65+ years, diagnosis (3 or more co-existing), visual impairment, and poly pharmacy (4 or more prescriptions – any type). Even if the patient had no impaired functional mobility or environmental hazards present, a score of 4 put him over the threshold of fall risk.[7] A limitation to his progress in ambulation was not having a ramp to the outside of his home, preventing use of a 4WW with full independence.

Some positive prognostic factors for this patient at DC were his adherence to PT recommendations, as well as having non-familial support available. Some negative prognostic

factors for this patient were his multiple comorbidities, as well as reports of continued bilateral calf pain. Though the patient may not have reached all his expected outcomes, progress was made in ankle strength and functional mobility that provided him with more independence than he had at the IE. He was now independent with transfers, as well as level surface ambulation and stair negotiation within the home. Likewise, when ambulating on uneven ground outdoors, he was steadier and could tolerate 300 ft of ambulation with his 4WW and the equipped white cane (Appendix 2). Providing the means to equip his white cane to his 4WW was meaningful to him (Table 6), even if some assistance was recommended for him to safely ambulate in the community. Cases like this would benefit from large research studies tailored to improving strength and functional mobility in geriatric patients with rhabdomyolysis, as PT interventions for this population are not yet well represented in the literature.

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Table 1. Patient Medications and Supplements

Medication/Supplement	Instructions/Dosage	Purpose (if specified)
B Complex Vitamin	1 tablet orally once daily.	N/A
Vitamin D	1,000 mg orally once daily.	N/A
COQ-10	100 mg orally once daily.	N/A
Fish Oil Concentrate	1,000 mg orally once daily.	N/A
Folic Acid	400 mg orally once daily.	N/A
Glucosamine Chondritin	750-600 mg orally twice daily.	Osteoarthritis pain
Piroxicam	20 mg orally once daily.	Anti-inflammatory
Timolol Maleate, Opthalmic	0.25% drop ophthalmic once daily.	Vision
Triamterene HCTZ	37.5 – 25 mg orally once daily.	Hypertension
Zinc	50 mg orally once daily.	N/A

Table 2. Systems Review (Initial Evaluation)

System	Impaired/Unimpaired	Impairments
Cardiopulmonary	Impaired	Patient had a slightly elevated BP of 133/72 (resting, left arm). Patient had decreased endurance marked by need for rest breaks with functional mobility.
Musculoskeletal	Impaired	Decreased bilateral LE strength.
Neuromuscular	Impaired	Patient had a right foot drop, as well as bilateral PN.
Integumentary	Impaired	Patient had a stage 2 sacral pressure ulcer resulting from his fall. It was intact and healing after treatment directly

		following fall.
Communication	Unimpaired	N/A
Affect, Cognition, Language, Learning Style	Unimpaired	Patient was alert and oriented. Had some understanding of medical language and learned best through verbal cuing.

Table 2: Blood Pressure (BP), lower extremity (LE), peripheral neuropathy (PN).

Table 3. Tests and Measures

Tests/Measurement	**Initial Evaluation**		**Discharge**	
Manual Muscle Testing (MMT)				
LE	**Left LE**	**Right LE**	**Left LE**	**Right LE**
Hip Flexion	4/5	4-/5	4-/5	4-/5
Hip Abduction	4/5	4-/5	4-/5	4-/5
Knee Flexion	4/5	4/5	4-/5	4-/5
Knee Extension	4/5	4/5	4-/5	4-/5
Ankle Plantarflexion	3+/5	3+/5	4/5	4/5
Ankle Dorsiflexion	3+/5	3/5	4/5	4/5
Outcome Measures				
Missouri Alliance for Health Care Fall Risk Assessment (MAHC 10)	6/10 (4 or greater is indicates increased fall risk).		6/10 (4 or greater is indicates increased fall risk).	
Performance Oriented Mobility Assessment (POMA)	Not assessed, patient well below cutoff score (<19) based on gait analysis and clinical judgement.		Patient scored a 16/28, which is predictive of increased fall risk.	
Vital Measurements				
Resting Pulse (Radial)	81 bpm		Not taken at discharge	
Blood Pressure (BP)	133/72 mmHg		Not taken at discharge	

371 **Table 4. Observational Analysis: Functional Mobility at Initial Evaluation**

Transfer	Description
Sit to stand	Patient required CGA and use of his arms to sit to stand safely. He was unsteady and had poor foot placement to provide leverage for standing.
Bed Mobility	Patient was independent with roll/turn, sit/supine, and scoot/bridge.
Gait Surface	
Level	Patient was able to ambulate x100 ft with B SPC and SBA before needing a rest break. He demonstrated an increasingly kyphotic posture, a wide BOS, a slight bend in both knees, and significant external rotation at the hips. His steps were discontinuous and cautious, and he demonstrated a short stride length. Some lateral sway was also noted.
Uneven	Patient was able to ambulate x50 ft outside with B SPC and minA. He demonstrated an increasingly kyphotic posture, a wide BOS, a slight bend in both knees, and significant external rotation at the hips. His steps were discontinuous and cautious, and he demonstrated a short stride length. Some lateral sway noted.
Stairs	Patient was able to negotiate 3 stairs on the steps of his porch with SPC, railing, and minA. He used a step by step pattern leading with the left foot and demonstrated unsteadiness likely from B LE weakness. Patient also had difficulty clearing the steps when ascending with his right foot due to foot drop.

372 Table 4: Contact guard assist (CGA), feet (ft), bilateral (B), single point cane (SPC), minimum assistance (minA),

373 base of support (BOS), lower extremity (LE).

374

375 **Table 5. Therapy Goals**

Goal	Status by Discharge
Short Term Goals (4 weeks)	
To be independent with a home exercise program to strengthen legs and improve balance.	Met (Week 3)
To complete a sit to stand transfer with no assistance prior to discharge allowing access to his home.	Met (Week 4)
Long Term Goal (at discharge)	
Patient will safely ambulate 300 feet with least restrictive device independently to allow	Partially Met; patient can ambulate this distance safely with his 4WW, but needs help

access to the community.	transporting the device in and out of his home with a SBA of 1 person.
Patient will independently negotiate 1 flight of stairs with least restrictive device prior to discharge to allow access to upstairs bathroom and basement.	Met (Discharge)
Patient will demonstrate 4+/5 bilateral lower extremity strength to facilitate independence with transfers and gait.	Not Met; Patient improved bilateral ankle strength to 4/5, but maintained or declined all other LE strength to 4-/5.

376 Table 5: Four-wheel walker (4WW), stand by assist (SBA), lower extremity (LE)

377

378 **Table 6. Interventions**

Intervention	**Purpose**	**Week 1** (2 sessions)	**Week 2** (2 sessions)	**Week 3** (2 sessions)	**Week 4** (1 session)
Therapeutic Exercise	*Instruct patient in LE HEP to increase strength and standing balance.*	Standing LE exercises, all 1x10 B: - Marching - Side kicks - Back kicks - Calf raises - Knee bends - AP/ML weight shifts - Mini squats	Seated ankle exercises/stretch - PF red TheraBand (1x10 B) - DF red TheraBand (1x10 B) - INV red TheraBand (1x10 B) - EV red TheraBand (1x10 B) - Calf stretch with strap (3x30s B) -	Independent with LE HEP, intervention not needed.	-
Transfer Training	*Promote safety and independent*	S1, S2: CGA sit to stand using	S3, S4: SBA sit to stand using arms	S5, S6: SBA sit to stand using arms	S7: CS sit to stand using arms

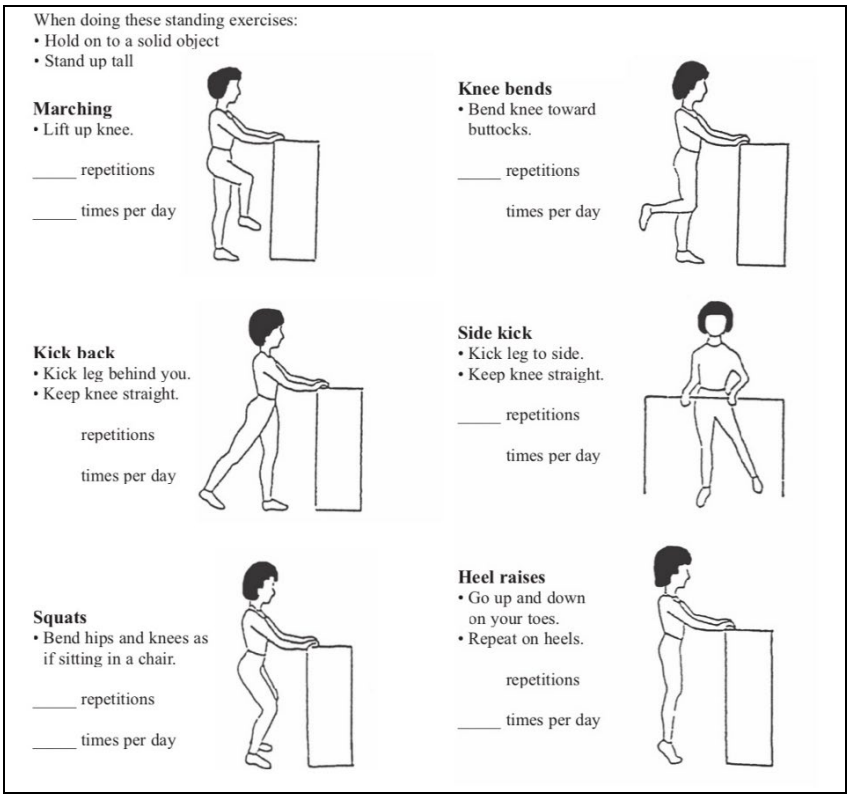
	transfers.	arms			
Gait Training	*Promote safe and independent ambulation on all surfaces.*	**Level** S1: B SPC x25ft SBA S2: B SPC x50ft SBA **Uneven** S1/S2: NP **Stairs** S1: B railings x9 steps, minA S2: NP	**Level** S3: B SPC x25ft SBA S4: B SPC x50ft SBA **Uneven** S3/S4: NP **Stairs** S3: B railings x2 steps, minA S4: NP	**Level** S5: B SPC x25ft SBA S6: B SPC x25ft SBA **Uneven** S5: 4WW x250ft, CGA, 2 RB needed S6: NP **Stairs** S5: SPC and railing x3 steps, SBA S6: 1x15 step FOS, CGA	**Level** S7: B SPC x25ft CS **Uneven** S7: 4WW x300ft, CGA, 2 RB needed **Stairs** S7: SPC and railing x3 steps, SBA
Maintain Adaptive Equipment	*Adapt and maintain AD for patient to safely use the least restrictive device.*	NP	NP	S5: Examined patients 4WW, checked stability and height settings S6: Safety checked equipment in BA	S7: Took measures for adaptive attachment
Education	*Education on various therapy topics to improve outcomes.*	Proper foot position for safe sit to stand transfer.	Decrease muscle soreness: - Energy conservation - Hydration	Self-pacing with gait and compensatory strategies for foot drop ascending stairs.	Educated patient on decreasing repetitions to decrease soreness.
Intervention	**Weeks 5** (2 sessions)	**Week 6-7** (2 sessions)	**Week 8-9** (2 session)	**Week 10 – Discharge** (post-clinical rotation; 6 sessions 1x/week)	
Therapeutic Exercise	-	-	-	-	

Transfer Training	Independent sit to stand transfer, no intervention needed.	-	-	-
Gait Training	**Level** S8: B SPC x50ft CS S9: B SPC x50ft CS **Uneven** S8: NP S9: 4WW x350ft, CGA, 2 RB needed **Stairs** S8: 1x15 step FOS, SBA S9: SPC and railing x3 steps, SBA	**Level** S10: B SPC x50ft CS S11: B SPC x30ft CS **Uneven** S10: 4WW x350ft, SBA S11: NP **Stairs** S10: SPC and railing x3 steps, SBA S11: 1x12 step FOS, SBA	**Level** S12: B SPC x30ft CS S13: B SPC, attempted x10ft SPC with CS **Uneven** S12: 4WW x300ft, SBA S13: NP **Stairs** S12: SPC and railing x3 steps, CS S13: NP	Patient continued to receive training for ambulation on all surfaces.
Maintain Adaptive Equipment	NP	Began design for 4WW w/white cane.	Completed design for 4WW w/white cane.	NP
Education	Joint OT visit, steps and shower transfer.	Continued emphasis on proper hydration.	Modifying base of support for SPC use in home.	Patient was educated on spacing out his exercises over the course of the day to prevent overexertion and reduce muscle fatigue.

379 Table 6: Lower extremity (LE), Home Exercise Plan (HEP), bilateral (B), anterior to posterior (AP), medial to
380 lateral (ML), plantarflexion (PF), dorsiflexion (DF), inversion (IV), eversion (EV), contact guard assist (CGA),
381 stand by assist (SBA), session (S), feet (ft), not performed this visit (NP) minimum assistance (minA), rest breaks
382 (RB), flight of stairs (FOS), bathroom (BA), occupational therapy (OT), Four-wheel walker (4WW)

APPENDICES

Appendix 1: Standing LE Exercises from Aurora Health Care Protocol[7]



Appendix 2: Adapted 4WW with White Cane

Left Image – Side view of adapted 4WW (wooden tray not part of design)
Right Image – Top view of adapted 4WW (wooden tray not part of design)

Appendix 2: Four-wheel walker (4WW)

389 **CARE Checklist**

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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.	3-4
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.	4-6
6. **Clinical Findings** – Relevant physical examination (PE) and other clinical findings	6-8
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.	6-8
9. **Therapeutic Intervention** a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	8-11 20-23
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)? d. Adverse and unanticipated events.	12
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.	12-14
12. **Patient Perspective** – The patient can share their perspective on their case.	4
13. **Informed Consent** – The patient should give informed consent.	4