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Functional Training To Reduce Fall Risk In A Patient Following Cancer Treatment: A Case Report

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

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I. **Title:** Functional Training to Reduce Fall Risk in a Patient Following Cancer Treatment: a Case Report

II. Abstract

Background and purpose: The National Cancer Institute reports that approximately 39.6% of individuals will be diagnosed with cancer during their lifetime.[1] Due to the large percentage of Americans affected each year, multiple studies have looked at the long-term effects of cancer treatment and survivorship on physical function. Studies have demonstrated that over half of cancer survivors age 55 and over have fallen in the past year, possibly as a result of treatment and subsequent muscle weakness, difficulty with balance, and impaired walking.[3] The purpose of this case report was to detail interventions aimed at these modifiable factors in a patient status post cancer treatment.[3]

Case description: The patient was a 76 year old female with a history of endometrial cancer, who participated in a total of 12 days of skilled PT services for an hour each day to address limitations in strength, balance, and aerobic capacity. Functional mobility and fall risk were assessed via six-minute walk test (6-MWT), initial score 107 feet, and Berg balance scale (BBS), initial score 31/56. Further interventions would have been preferred, but patient stay was shortened secondary to insurance denial.

Outcomes: Following 12 days of PT services, the patient's functional mobility improved as assessed by an increased walking distance of 517 feet on the 6-MWT and decreased fall risk assessed by the BBS of 43/56.

Discussion: This case report demonstrated that by addressing three modifiable risk factors associated with increased fall risk in cancer survivors, the patient saw improvements in functional mobility and fall risk.

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III. Background and purpose

Cancer effects millions of Americans annually, and according to data reported by the National Cancer Institute during 2010-2012, approximately 39.6% of men and woman will be diagnosed with some form of cancer during their lifetime.[1] Of these global statistics, 25.1 new cases of endometrial cancer will be diagnosed per 100,000 women per year, carrying a death rate of 4.4 deaths per 100,000 women annually.[1] According to this data, 2.8% of women will develop endometrial cancer during their lifetime.[1]

With a large percentage of Americans affected by cancer each year, multiple studies have demonstrated the long-term effects of cancer survivorship and its treatment on physical function. Stubblefield et al[2] demonstrated that "53% of adult onset cancer survivors have problems with physical function as a result of their cancer and/or its treatment." A study by Huang et al[3] demonstrated that "54% of cancer survivors 55 years and older have fallen at least once within the past 12 months. Chemotherapy, hormonal therapy, muscle weakness, difficulty with balance and difficulty with walking have been linked to increased falls in this patient population.[3]

While multiple studies demonstrate that a link exists between cancer survivorship and diminished physical function, especially falls, few studies suggest interventions to prevent future falls and further decline in function. The purpose of this case report was to report the interventions utilized in the treatment of an individual post-cancer treatment, with the intention of decreasing future fall risk by addressing three modifiable factors: muscle weakness, balance impairment, and walking difficulty.[3]

III. Case description

Patient history and review of systems

The patient, AB, gave written consent allowing the use of medical information for this report. AB was a 76-year-old female referred to skilled nursing facility (SNF) with a medical diagnosis of nausea, vomiting, and diarrhea secondary to radiation enteritis. AB had a significant past medical history for endometrial cancer, and was treated with radiation, which was projected as the cause for her most recent complaints. This patient presented to skilled physical therapy (PT) services with decreased functional mobility inhibiting her ability to safely return home to her two-story house.

One year ago, AB was diagnosed and treated for stage three endometriod adenocarcinoma for which she underwent total abdominal hysterectomy, bilateral salpingo-oophorectomy, and bilateral pelvic lymph node dissection as well as radiation treatment. Ten months ago, the patient was started on warfarin for treatment of deep vein thrombosis in the left leg possibly caused by immobility associated with cancer treatment. Four months ago, AB was treated for shingles virus and over the past three months reported prolonged periods of nausea, vomiting and diarrhea. One month ago, AB was admitted for gastro-intestinal bleeding. At admission, a colonoscopy was performed showing severe break down of the stomach, but did not reveal the source of the bleed. The patient was treated and discharged home, but was still experiencing recurrent nausea, vomiting and diarrhea, and three weeks later was readmitted to the emergency department. At this admission, AB received the medical diagnosis of radiation enteritis as the cause of her ongoing complaints. Due to recurrent hospitalizations and the patient's report of poor overall health status and recurrent fall history, AB was referred to skilled nursing to improve functional mobility and ensure safe discharge home when appropriate.

Table 1 details the results obtained from a systems review.

Clinical impression I

AB presented to SNF with decreased functional mobility as a result of prolonged immobility. Her immobility resulted in impairments of the cardiovascular system, musculoskeletal, and integumentary and neuromuscular systems. Her system impairments resulted in difficulty with bed mobility, transfers, ambulation, balance, strength, activity tolerance, and stair navigation. These activity limitations inhibited her function within the home and prevented her from going out into the community. AB's primary complaint was decreased functional mobility, as a result of impaired cardiovascular, musculoskeletal, and neuromuscular systems.

Following the subjective history and systems review it was hypothesized that AB presented with decreased functional mobility secondary to decreased cardiovascular endurance, lower extremity gross strength, and balance impairments. Additional tests and measures to confirm or refute this hypothesis included: Berg balance scale (BBS) and six minute walk test (6-MWT).

Functional mobility was first examined within the confines of her room to determine if she was safe performing these functional tasks independently or if she needed assistance from nursing staff to maintain safety. As a result of the patient's report of multiple falls within the last year, it was important to obtain a comprehensive balance assessment via the BBS, and secondary to patient's prolonged immobility a cardiovascular endurance measurement was important to obtain; 6-MWT.

This patient continued to be a good candidate for a case report because her impairments in the cardiovascular, musculoskeletal and neuromuscular systems were

consistent with the modifiable risk factors established with increased fall risk in patients who have been treated for cancer.[3]

Examination

A standardized examination was performed (Table 2), which details the test and measures performed and reports on the established reliability and validity when available. Gross strength and range of motion were assessed to determine if asymmetries were present that may contribute to increased fall risk. An observational gait analysis was performed to assess gait pattern, fall risk/safety awareness, and obtain a gross measure of endurance. Gait was further assessed using the 6-MWT, which helped to quantify cardiovascular endurance. Balance was initially assessed via gross assessment of seated and standing balance, and further assessed using the BBS, which also helped to quantify fall risk. Bed mobility, transfer, and stair assessments were performed to assess for functional mobility impairments. Gross sensation measurements were performed to rule in or out neuropathy, which could contribute to fall risk.

Clinical impression II

The data obtained during the examination confirmed the initial impression of severe deconditioning resulting in decreased functional mobility as a result of prolonged immobility. The patient presented with decreased cardiovascular endurance as evidenced by the 6-MWT, decreased lower extremity strength as assessed with manual muscle testing, and decreased balance/increased fall risk as demonstrated by the BBS. These

findings were consistent with the clinical impression of decreased functional mobility secondary to deconditioning.

Following the examination, it was decided to proceed with interventions as well as refer the patient to occupational therapy. During the history the patient stated the need for minimal assistance with basic activities of daily living (ADLs), and it was determined that she would benefit from occupational therapy to promote independence with these tasks.

Based on the data obtained from the initial evaluation, it was evident that the patient had poor lower extremity strength, balance and endurance. Interventions focused on increasing the patient's activity tolerance through aerobic conditioning to allow her to complete household ambulation and grocery shopping in the community without tiring. Her lower extremity strength was addressed to increase her ability to complete transfers and bed mobility independently and make ascending/descending stairs less difficult. Her poor dynamic standing balance and safety awareness were also addressed through interventions to decrease the risk for future falls. At each weekly progress note, a gross assessment of the patient's endurance, strength and balance were assessed. At discharge, the 6-MWT and BBS were re-assessed to determine if gains were made.

Evaluation

AB was hospitalized numerous times within the past year for cancer treatment, a DVT, shingles, a fall, and most recently nausea, vomiting, and diarrhea as a result of radiation enteritis. Due to her medical treatment and medical instability over the past year, this patient was sedentary, and as a result became deconditioned. The patient

presented with decreased endurance as evidenced by the 6-MWT, decreased balance as evidenced by the BBS, and decreased lower extremity strength as evidenced by gross manual muscle testing. These impairments negatively impacted her ability to independently complete bed mobility, transfers, ambulation and stairs safely. Examination demonstrated that this patient had severely limited aerobic capacity and was placed at a moderate fall risk based on the outcome measures assessed.

As a result of AB's impaired cardiovascular endurance and activity tolerance, she was unable to walk greater than thirty feet without experiencing shortness of breath, which inhibited her ability to complete light household tasks as well as community activities. The patient's impaired lower extremity strength and balance inhibited her ability to safely navigate the stairs to enter/exit the home and independently transfer into a car. The patient's inability to safely and independently enter/exit the home inhibited her participation in the community.

AB's extensive medical history largely impacted her plan of care. As a result of cancer treatment, this patient was experiencing frequent episodes of stomach irritability, nausea, vomiting and diarrhea secondary to radiation enteritis. In turn, AB had a difficult time maintaining a hydrated state, which significantly contributed to her high levels of fatigue. It was difficult to determine a timeline for her prognosis because at the time of evaluation she was still experiencing infrequent bouts of nausea, vomiting, and diarrhea. Her infrequent episodes had the potential to affect treatment sessions, as she may not have felt well enough to participate. This patient also had a severely compromised immune system secondary to cancer treatment, as evidenced by her medical history the

past year, which could have also negatively impacted participation in daily treatment sessions.

Diagnosis

AB presented with impairments in her cardiovascular, neuromuscular and musculoskeletal systems contributing to her decline in functional mobility. Due to her multisystem deficits, three diagnostic categories from the *Guide to Physical Therapist Practice* were selected. The primary diagnosis, "Impaired Aerobic Capacity/endurance associated with deconditioning" was chosen due to the patient's complaint of shortness of breath following minimal exertion, low score on the 6-MWT, and associated deconditioning. Secondary diagnoses of impaired muscle performance and primary prevention/risk reduction for loss of balance and falling were chosen based on results from the examination, decreased lower extremity strength as well as history of fall and balance impairments. Code 719.7 difficulty walking and 781.99 decline in functional mobility were chosen as relevant ICD-9 codes.

Prognosis

AB had a supportive family, a strong drive to get better, and a social history in the field of physical therapy and knew what needed to be accomplished in order to improve. At initial evaluation, AB was cancer free and her complaints of nausea, vomiting and diarrhea were occurring less frequently, and it was felt that her medical status was stabilized. A study by Sandler et al[8] reported that patients with physical deconditioning following two weeks of immobility required at least three weeks of rehabilitation to reach

pre-bed rest state of cardiovascular conditioning. Based on the results from this study, one can extrapolate that this patient would require a minimum of four weeks to reach her stated goals based on her comorbidities and low level of previous physical activity.

Plan of care:

Physical therapy goals for AB focused on attaining a level of functional mobility that ensured safe discharge home. This included independent ambulation at both household and community distances with the least restrictive assistive device, the ability to ascend/descend the three steps into her home with a single railing and supervision, as well as demonstrate good dynamic standing balance to decrease her risk for future falls.

Interventions

AB resided at the SNF for a total of 14 days, of which she participated in skilled PT services for 12 days. The patient participated in skilled PT services six days per week, with each session lasting approximately one hour, excluding initial evaluation and discharge, with the end goal of safe discharge home.

Coordination/communication/documentation, patient/client related instruction: While residing at the SNF, AB was also receiving nursing and occupational therapy services, so communication across all disciplines was important for coordination of care, especially regarding safe patient transfer status with the nursing staff. The patient was educated on the potential benefits of participating in skilled PT services including improvements in function, safety during transfers and mobility with all forms of assistive devices, and on how to properly complete a home exercise program.

Procedural interventions: AB presented with limitations in strength, balance, and cardiovascular endurance, inhibiting her ability to safely complete bed mobility, transfers, ambulation and stair navigation. Interventions were chosen to address her impairments in order to restore participation in activities of daily living as well as decrease risk for future falls. Table 3 details the purpose of each intervention selected.

Aerobic training interventions were initiated by having the patient complete up to 15 minutes on the Nu-Step[*] and complete gait training daily. AB's gait training was progressed as the patient demonstrated ability to tolerate ambulation for longer distances, as characterized by decreased episodes of shortness of breath and safe gait patterns with assistive device, initially a rolling walker[†] then rollator[‡]. Aerobic conditioning was progressed on the Nu-step by increasing the load when 15 minutes of activity could be tolerated. Increasing her aerobic capacity through endurance training allowed her to ambulate for longer distances prior to fatiguing.

The patient presented with gross weakness of the lower extremities; this was addressed with a seated strengthening program for the major muscle groups. A seated exercise program was chosen initially due the patient's low tolerance for standing and impaired balance.

Balance interventions were initiated on a firm surface to get the patient acclimated to standing for long periods. After two days of balance training the patient was able to demonstrate fair+ static standing balance, as characterized by minimal disturbances in postural sway with single upper extremity (UE) support. The activity was then progressed

[*] Nu-Step T4r 511, Venture Drive, Suite 1, Ann Arbor, MI, 48108
[†] Lumex Everyday dual release walker with 5" wheels, 336 Trowbridge Dr, Fond Du Lac, WI, 54937
[‡] Walkabout Lite Rollator, Lumex, 336 Trowbridge Dr, Fond Du Lac, WI, 54937

to dynamic standing balance on the foam Airex pad[§]. On the foam airex, her balance was challenged to a greater extent and more postural sway was noted when reaching outside of her base of support.

The last intervention provided to the patient was stair training to allow her to safely enter and exit her house. Stair training was initiated with contact guard level of assistance and bilateral UE support while ascending and descending three steps. Once the patient demonstrated a safe step through gait pattern, the level of external assistance was decreased to distant supervision and the patient required only single UE support. Progressing the patient to distant supervision and single UE support most closely mimicked the activity in the patient's home environment, and served as criterion to allow for safe discharge home. Table 4 demonstrates the progression of gait, transfer, and stair training over a two week time period.

Outcomes

Table 2 details the outcome measures assessed upon initial evaluation and discharge. The same therapist completed all measures at initial evaluation and discharge to maximize reliability of testing. AB progressed in all outcomes measured and partially achieved her goals of independent bed mobility, transfer with distant supervision, ambulation over 500 feet with rollator and supervision, tolerated fifteen minutes of aerobic activity while maintaining stable vitals, ascend/descended three steps with a single rail and distant supervision, fair+ dynamic standing balance without UE support,

[§] Airex Balance Pad, Industrie Nord 26, CH-5643 Sins, Switzerland

and independence with home exercise program for lower extremity strengthening and activity tolerance maintenance.

AB demonstrated improvements beyond the minimal detectable change in her scores on the 6-MWT test and BBS, as seen in figures 1 and 2 respectively.[13, 14, 15]

Discussion

Multiple studies have been completed that demonstrate the long lasting effects of cancer treatment on functional mobility, especially fall risk, but few demonstrate ways to mitigate the decline. According to a study by Huang et al[3], muscle weakness and difficulty with balance and walking have been linked to increased falls in cancer survivors. At admission to the SNF, AB presented with lower extremity muscle weakness, impaired seated and standing balance, impaired gait and ambulation distance, as well as a history of falls. During her stay, AB participated in interventions aimed at addressing these three modifiable risk factors to potentially decrease her risk for future falls. With the interventions provided, AB showed improvements in functional mobility, balance and lower extremity strength, as well as improved cardiovascular endurance and fall risk as assessed by the 6-MWT and BBS respectively. Factors that may have positively affected AB's outcome include the therapy provided, medical stabilization, patient motivation and family support.

AB was not able to fully meet all therapy goals due to an insurance denial that stated that payment would not be covered for a stay greater than fourteen days, but functional improvement was still noted. As demonstrated in figures one and two, AB showed significant improvements beyond the minimal detectable change on the 6-MWT

and BBS[14, 15], even though her scores were still significantly lower than those of her age matched peers.[13] Despite an initial prognosis of four weeks, AB was able to demonstrate improvements in functional mobility, as demonstrated by the BBS and 6-MWT scores, in just 12 days of PT services. The patient reached a level of functional mobility in which she could be safely discharged home with home health PT. This leads one to question if further PT in the home setting resulted in further improvements in functional mobility and if this could be maintained.

A study by Theis et al[16] demonstrated that about 20% of patients treated with radiation to the pelvic area experience complications of chronic radiation enteritis affecting their quality of life. Chronic radiation enteritis can result in prolonged periods of nausea, vomiting, and diarrhea which can lead to increased levels of fatigue and decreased levels of physical activity.[16] AB experienced prolonged periods of nausea, vomiting and diarrhea secondary to radiation enteritis, which left her immobile for days at a time. Kortebein et al[17] demonstrated that bed rest of just ten days produced significant declines in muscle strength, power, and aerobic capacity in elderly patients. Due to the complications associated with cancer treatment that left her immobile, AB experienced these detriments in functional mobility associated with bed rest; decreased lower extremity strength, balance, and aerobic capacity.

AB came to the SNF with the goal of stabilizing her overall health and restoring functional mobility for a safe return home. Sandler et al[8] reported that patients with physical deconditioning following two weeks of immobility required at least three weeks of rehabilitation to reach pre-bed rest state of cardiovascular conditioning. Although the patient was unable to stay at the SNF for the projected four weeks,[8] with 12 days of PT

interventions the patient was still able to demonstrate functional improvements. AB showed improvement in her functional mobility and fall risk, as assessed by the SMWT and BBS, as well as improved in the functional detriments associated with radiation enteritis and prolonged immobility.[16, 17]

Multiple studies have been completed that demonstrate the long lasting effects of cancer treatment on functional mobility, but few studies demonstrate a way to prevent the decline in functional mobility or interventions to address the decline once present. AB participated in 12 days of PT interventions that resulted in improvements in functional mobility and fall risk as assessed by the SMWT and BBS. Further research is needed to determine the long-term impact of the interventions provided on the goal mitigating the functional decline associated with cancer treatment.

IV. References

1. Howlader N, Noone AM, Krapcho M, Garshell J, Miller D, Altekruse SF, et al. SEER Cancer Statistic Review, 1975-2012, National Cancer Institue. Bethesda, MD, htto://seer.cancer.gov/csr/1975_2012/. Based on November 2014 SEER data submission, posted to the SEER website, April 2015.
2. Stubblefield M, Schmitz K, Ness K. Physical functioning and rehabilitation for the cancer survivor. *Semin Oncol.* December 2013;40(6):784-795. Available from: MEDLINE, Ipswich, MA. Accessed June 27, 2015.
3. Huang M, Lytle T, Miller K, Smith K, Fredrickson K. History of falls, balance performance, and quality of life in older cancer survivors. *Gait & Posture.* July 2014;40(3)451-456. Available from: MEDLINE, Ipswich, MA. Accessed June 27, 2015.
4. Berg KO, Maki BE, Williams JI, Holiday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. *Arch Phys Med Rehabil.* 1992;73(11):1073-1080.
5. Shumway-Cook A, Baldwin M, et al. Predicting the probability for falls in community-dwelling older adults. *Phys Ther.* 1997;77(8): 812-819.
6. Steffen TM, Hacker TA, et al. Age- and gender-related test performance in community-dwelling elderly people: Six-Minute Walk test, Berg Balance Scale, Timed Up & Go test, and gait speeds. *Phys Ther.* 2002;82(2):128-137.
7. Harada N, Chiu V, et al. Mobility-related function in older adults: assessment with a 6-minute walk test. *Arch Phys Med Rehabil.* 1999:80(7):837-841.
8. Sandler H, Pott RL, Harrison DC: The hemodynamic effects of repeated bed rest exposure. *Aviat Space Environ Med.*1988:59:1047-1054
9. Chen MS, Lin TC, Jiang BC. Aerobic and resistance exercise training program intervention for enhancing gait function in elderly and chronically ill Taiwanese patients. *Public Health.* 2015, http://dbx.doi.org/10.1016/j.puhe.2015.04.018
10. Park JMS, Joongsook L, Jeongok Y, Bomjim L, Dongwook H. Effects of combined exercise on changes of lower extremity muscle activation during walking in older women. *J Phys Ther Sci.* May 2015:27(5):1515-1518.
11. Tanaka H, Uetake T. Characteristics of postural sway in older adults standing on a soft surface. *J Hum Ergol (Tokyo).* December 2005:34(1-2):35-40
12. Donath L, Faude O, Roth R, Zahner L. Effects of stair-climbing on balance, gait, strength, resting heart rate, and submaximal endurance in healthy seniors. *Scand J Med Sci Spor.* 2014:24(2)93-101.
13. Lusardi M. Functional Performance in Community Living Older Adults. *Journal of Geriatric Physical Therapy. 2003:26(3):14-22.*
14. Perera S, Mody S, et al. Meaningful change and responsiveness in common physical performance measures in older adults. *J Am Geriatr Soc.* 2006; 54(5): 743-749.
15. Donoghue D, Stokes EK. How much change is true change? The minimum detectable change of the Berg Balance scale in elderly people. *J Rehabil Med.* 2009:41(5): 343-346.
16. Theis VS, et al. Chronic radiation enteritis. *Clin Oncol.* Feb 2010:22(1):70-83.

17. Kortebein P, et al. Functional impact of 10 days of bed rest in healthy older adults. J Gerontol A Biol Sci Med Sci. 2008;63(10):1076–1081.

Table 1. Data obtained from systems review

Cardiovascular/Pulmonary	
Impaired	Following 30ft of in room ambulation, heart rate increased to 102 beats per minute and patient became short of breath
	Edema is present at bilateral ankles, 2+ on the right 3+ on the left
Integumentary	
Impaired	Bruising present at right antecubital space secondary to lines placed during hospitalization
Musculoskeletal	
Impaired	Gross strength impairments of bilateral lower extremities
	Gait is impaired secondary to limitations in lower extremity strength, cardiovascular endurance and balance
Neuromuscular	
Impaired	Decreased balance in standing characterized by increased sway
Communication, Affect, Cognition, and Learning Style	
Not Impaired	

Table 2. Outcome measures at initial evaluation and discharge

Tests & Measures	Initial Evaluation Results	Discharge results
Gross strength	B/L LE 3+/5 except L hip flexion 3/5, B/L UE WFL	B/L LE 4/5 except L hip flexion 3+/5, B/L UE WFL
Gross ROM	WFL	WFL
Gait* (observational gait analysis)	Patient ambulated 30ft with RW and CGA	Patient ambulated 500+ft with 4WW and distant S
Static sitting balance* (gross)	Good[#]	Good[#]
Dynamic sitting balance* (gross measurement)	Fair[#]	Fair+[#]
Static standing balance* (gross measurement)	Poor+[#], increased sway with bilateral UE support	Good[#], no sway noted without UE support
Dynamic standing balance* (gross measurement)	Poor[#], increased sway with SLS and reaching outside of BOS	Fair+[#], only one episode of increased sway when reaching outside of BOS in SLS
Bed mobility	Min assist x1	Independent
Transfer*	Sit to stand and stand to sit, min assist of one	Independent
Stairs*	Min assist, one step ascending/descending with bilateral rails	Distant S for ascending/ descending 3 steps with unilateral rail
Sensation	WNL to light touch	WNL
Cognition	Alert and oriented x 4	Alert and oriented x 4
Safety awareness*	Poor[#], use of assistive device inadequate, safety risk	Good[#]
Endurance*	Poor[#], shortness of breath following ambulation of 30ft, O_2 Sat 94% on room air	Fair[#], walking up to 500 ft O_2 Sat 93% on room air
BERG[4,5]	31/56, moderate fall risk	43/56, low fall risk
6 Minute Walk Test[6,7]	170 ft, HR pre: 88 bpm, post test: 102 bmp, O2 sat: Pre: 96%, Post: 94%	517 ft, HR pre: 86 bmp, post test 98, O2 sat pre: 96%, post: 93%

Key: *= assessed functionally, #= assessed on poor, fair, good scale, UE= upper extremity, LE= lower extremity, B/L= bilateral, U/L=unilateral, WFL= within functional limits, RW= rolling walker, 4ww= four wheeled walker/rollator, CGA=contact guard assist, S= supervision, MMT= manual muscle testing, SLS= single leg stance, BOS= base of support, AD= assistive device

Table 3. Purpose of interventions

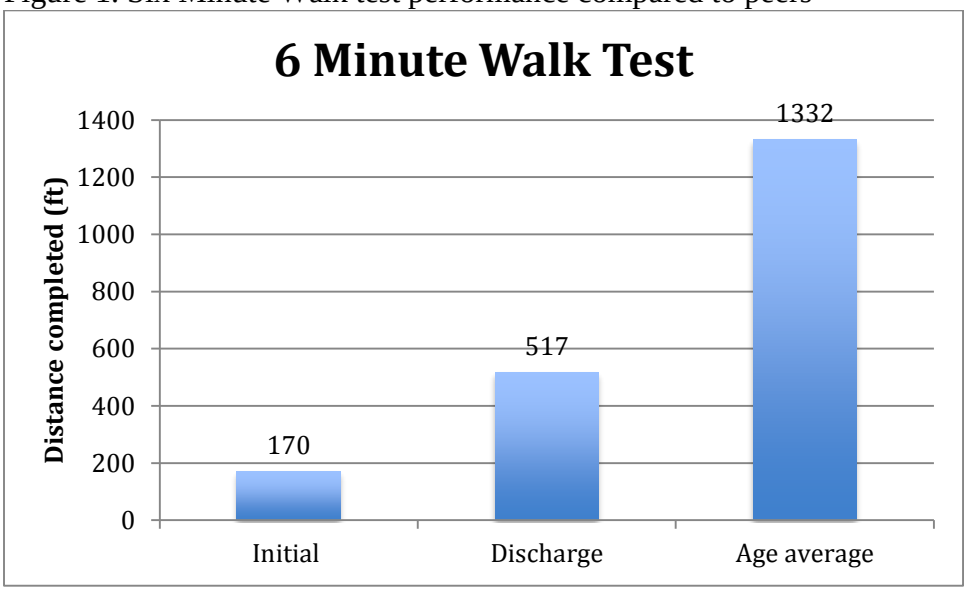
Intervention	Goal/purpose
Gait training indoors	Promote a safe gait pattern with an assistive device and increase activity tolerance to allow ambulation up to 300 ft. Promote improvements in gait parameters, muscle strength and postural stability. [9,10]
Gait training outdoors	Promote safe gait pattern on uneven surfaces to allow patient to safely ambulate in the community. Promote improvements in gait parameters, muscle strength and postural stability. [9,10]
Seated lower extremity strengthening	Increase lower extremity strength to aid in functional tasks, such as bed mobility, transfers, and stair navigation. Promote improvements in gait parameters, muscle strength and postural stability. [9,10]
Transfer training	Promote safe independence during transfers from varying surfaces to promote carryover to her home environment
Activity tolerance training on Nu-Step	Increase patient's activity tolerance to allow her to walk first household then community distances without becoming short of breath. Promote improvements in gait parameters, muscle strength and postural stability. [9,10]
Standing tolerance training	Promote safe, independent, and good static standing balance to aid patient in completion of ADLs, such as dishes, washing up at the sink etc, as well as aid in balance training
Standing lower extremity strengthening	Further challenge lower extremity strength to aid in functional tasks, such as bed mobility, transfers, and stair navigation. Promote improvements in gait parameters, muscle strength and postural stability. [9,10]
Standing dynamic balance training	To promote improvements in balance to decrease risk for future falls. To challenge postural sway and promote compensation mechanisms.[11]
Stair training	To promote safe discharge home, as patient had to be able to ascend/descend three steps with single rail to enter/exit the home. Decrease resting and exercising heart rates, rate of perceived exertion, and increase dynamic standing balance.[12]

402 Table 4. Progression of physical therapy interventions by week

Intervention	Rx week one	Rx week two		
Gait training	RW and CGA	4WW and distant S		
Transfer training	Min assist x 1	Distant supervision		
Stair training	Not addressed	B/L UE support, CGA	U/L UE support, CGA	U/L UE support, distant S

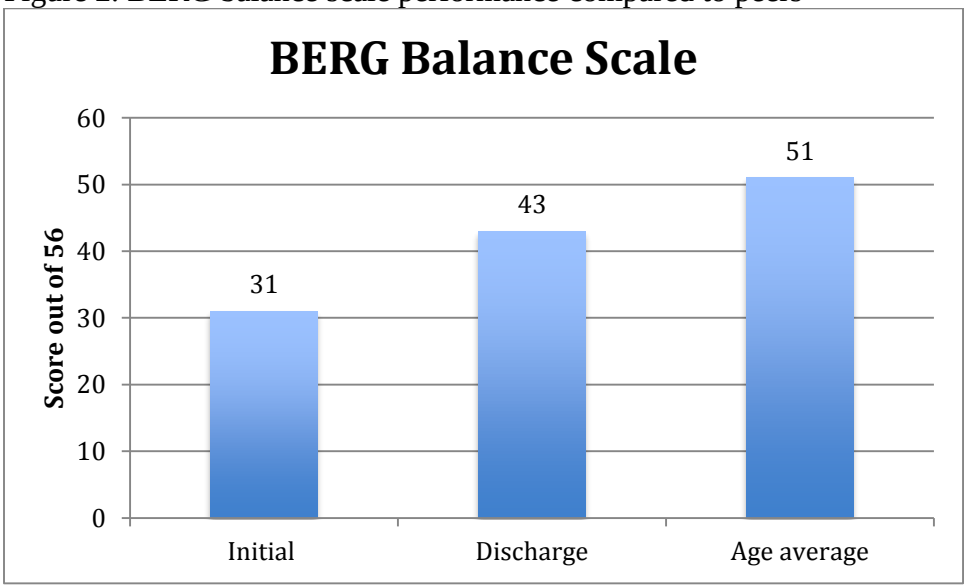
Key= RW= rolling walker, 4WW= four wheeled walker, rollator, CGA= contact guard assist, S=supervision, UE= upper extremity, B/L= bilateral, U/L= unilateral

Figure 1. Six Minute Walk test performance compared to peers [13]



Minimal detectable change (MDC)=190 ft[14]

Figure 2. BERG balance scale performance compared to peers [13]



Minimal detectable change (MDC)=5 points[15]