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Restoring Functional Mobility For A Geriatric Patient Following Open Repair Of A Ruptured Abdominal Aortic Aneurysm: A Case Report

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The patient signed a consent form for the use of her medical information and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act.

Key Words: Ruptured Abdominal Aortic Aneurysm, Physical Therapy

Abstract

Background and Purpose: Each year 200,000 people are diagnosed with an abdominal aortic aneurysm (AAA) in the United States and the mortality rate for ruptured AAA is estimated to be 80%. There are two surgical options to treat ruptured AAA, an open repair and an endovascular aneurysm repair (EVAR). The incidence of rupture following an EVAR is 0.9%. The purpose of this case report was to describe the physical therapy (PT) plan of care of an elderly patient following an open repair of a ruptured AAA with a history of EVAR.

Case Description: The patient was an 86-year-old female admitted to the skilled nursing facility following an open repair of a ruptured AAA with a history of EVAR. The patient presented with the primary problems of decreased lower extremity (LE) strength, balance, and activity tolerance. Interventions focused on improving her tolerance for functional mobility through strength, gait, and balance training.

Outcomes: At discharge, the patient showed improvements in her LE strength bilaterally (3+/5 [Fair +] to 4+/5 [Good +]) and her tolerance for ambulation (75 to 500 feet) with a two-wheeled walker. The patient had a small increase in her Berg Balance Scale score (34/56 to 37/56) and improved her Timed Up and Go score (25.29 to 16.75 seconds).

Discussion: Strength, balance, and gait training appeared to be successful PT interventions in the rehabilitation of a geriatric patient following open repair of ruptured AAA. Due to the rarity of this specific patient case, large-scale studies are unlikely; however, due to the lack of recommendations there is a substantial need for future research into PT protocols for this patient population in general.

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Background and Purpose

An *abdominal aortic aneurysm* (AAA) is defined as a dilation of the abdominal aortic artery greater than three centimeters involving all layers of the vessel wall.[1] In the United States (US) alone, 200,000 people are diagnosed with AAA each year.[2] Smoking history, male gender, advanced age, high blood pressure, coronary artery disease, obesity and Caucasian race are among some of the greatest risk factors.[3] The risk of rupture is highly dependent on the size of the AAA. For a patient with a four to five centimeter diameter AAA the annual rupture risk is 0.5-5%, while a diameter greater than eight centimeters has an annual rupture risk of 30-50%.[4] The mortality rate for ruptured AAA is estimated to be 80%, and despite women being at a lower risk for AAA, they tend to be at a higher risk for rupture at smaller sizes.[1]

There are two surgical options for the treatment of AAA, open repair and endovascular aneurysm repair (EVAR). The incidence of rupture following an EVAR is 0.9%, with the mean time to rupture at 37 months.[5] The 30-day mortality rate following repair of a ruptured EVAR is 32%.[5] A summary of these statistics is provided in Table 1. An *endoleak* is a complication following EVAR when blood leaks into the aneurysm sac. The two leading causes of rupture following EVAR are type I and type III endoleak, respectively.[5] A type III endoleak, see Figure 1, occurs when there is a defect between the parts of endografts causing an increase in the systemic pressure in the aneurysm sac therefore increasing the risk of rupture.[6]

There is limited research on the role of physical therapy (PT) following ruptured AAA, despite physical functioning being reduced following AAA repair.[7] According to Polastri et al.[8] postoperative AAA repair rehabilitation should focus on improving muscle activity, ambulation, and restoring activities of daily living (ADLs), but no specific interventions or protocols were recommended. Wnuk et al.[9] aimed to compare forward and backward walking to classic postoperative PT in males who underwent elective AAA repair. The study found no statistically

significant influence on length of stay or outcomes between the various treatment methods. All groups showed a reduction in distance covered post-operatively during the 6-minute corridor test compared to their pre-operative test, but the backward walking group had a smaller decrease in distance covered compared to the control group. However, this study was limited by its small sample size (n=65) and a lack of long term follow up. A systematic review completed by Martínez-Velilla et al.[10] concluded that, in general, interventions for acutely hospitalized elderly patients should include short daily walks, balance and gait retraining exercises, and resistance training that includes functional activities simulating ADLs.

This case report is needed in order to address the lack of available literature regarding PT management of patients following AAA rupture repair. The purpose of this case report was to describe the PT plan of care of an elderly patient following an open repair of a ruptured AAA with a history of EVAR.

Patient History and Systems Review

The patient provided written consent to participate in this case report. The patient was an 86-year-old Caucasian female who presented to the skilled nursing facility (SNF) following an open repair of a ruptured AAA. She had been taken to the hospital via ambulance with complaints of sudden onset back pain. A computed tomography (CT) scan revealed a ruptured AAA with active arterial extravasation with a large periaortic and left sided retroperitoneal hematoma. She was diagnosed with acute hemorrhagic shock due to a ruptured AAA type III endoleak. She immediately underwent an open aorta biliac repair of the ruptured AAA and explant of Endologix (Endologix Irvine, CA) endograft with intraoperative resuscitation. The patient's significant past surgical history included a ventral hernia repair with mesh x4 and an EVAR with an Endologix device six years prior. The patient's significant past medical history included hyperlipidemia, hypertension, hyperglycemia, gastroesophageal reflux disease, and acute kidney

failure. The patient had no family history of AAA, but did have a history of smoking. Details of the extent of her smoking history were unknown. Prior to this hospitalization the patient lived independently in her home but received help from her two children who lived locally for grocery shopping and a housekeeper for major housework. She drove herself to her favorite local deli approximately five days a week for lunch and planned to continue this routine once discharged. She did not utilize any assistive device at home or in the community but did have grab bars in her bathroom and railings on the two stairs to enter her home. The patient's marital status was unknown, and she was retired from her job assisting the occupational therapy (OT) department at a hospital.

She suffered a fall six months prior, which resulted in a hematoma and laceration to her head. She reported being in and out of the hospital and rehabilitation for months after the fall but eventually returned home independently. Despite her fall history, the patient had no fear of falling and did not feel unsteady when standing or walking. Past interventions for this episode of care included inpatient rehabilitation with OT and PT at the hospital for 10 days before being discharged to the SNF for continuation of OT and PT. The results of the systems review are summarized in Table 2, and her extensive medication list in Appendix 1. She was a pleasant and motivated woman whose primary concern was to return home independently and to be able to walk again. The patient presented to the SNF with the primary problems of decreased lower extremity (LE) strength, decreased static and dynamic balance, decreased activity tolerance and increased pain levels. Due to her postoperative state there were no differential diagnoses. Based on the patient's presentation at the initial evaluation, the Berg Balance Scale and Timed Up and Go tests were selected to assess the patient's fall risk. This patient was a good candidate for a case report based on her motivation to participate in therapy and her significant current and past medical history making her a unique patient.

Examination – Tests and Measures

Based on the patient's presentation at initial evaluation and her goals, multiple tests and measures were completed, as summarized in Table 3. The patient's LE strength was assessed via Manual Muscle Testing (MMT).[11] Hip flexion, hip abduction, hip adduction, knee flexion, knee extension, and ankle dorsiflexion were assessed bilaterally in a seated position as a modification for the patient. The muscles were assigned a strength grade as described by Kendall.[11] According to Fan et al.,[12] MMT of the LE muscles had adequate to excellent interrater reliability (ICC= 0.66-1.00) when tested in intensive care unit patients and simulated patients. The Timed Up and Go (TUG) test was performed in order to identify the patient's risk of falls. The TUG required the patient to rise from a chair, walk 3 meters as quickly and safely as possible, turn around and return to sit in the chair.[13] Cook et al.[14] found the TUG to have a high interrater reliability of 0.98, a sensitivity of 87% and specificity of 87% in predicting falls in community-dwelling elderly people. The Berg Balance Scale[15] (BBS) is a test that scores the patient's ability to perform 14 balance tasks using a five point scale and determines their risk of falling based on their total score, as described in Appendix 2. A study by Conradsson et al.,[16] aimed at identifying the intrarater reliability of the BBS in older adults living in residential care facilities, found the test to have a relative intrarater reliability of ICC= .97. The patient's functional mobility was assessed by observing her ability to perform bed mobility including transitioning from supine to sitting and sitting to supine, transfers from her bed to her wheelchair, and ambulating on level surfaces. Each activity was rated based on assistance level required according to Scalzitti.[17] There is no research on the psychometric properties of functional mobility assessments, however, it was valid for the purpose of this case as a general screening of her current abilities.

Clinical Impression: Evaluation, Diagnosis, Prognosis

Based on the patient's presentation following the examination, particularly her LE

weakness, increased risk for falls and balance deficits, the physical therapist's initial impression was confirmed, and she continued to be an appropriate candidate for the case report. The PT ICD-10 code assigned to the case was R26.2 *Difficulty in walking, not elsewhere classified*. The medical ICD-10 codes assigned to the case are summarized in Appendix 3. The patient had an excellent prognosis for improvement with physical therapy based on the therapist's clinical experience as well as the patient's high prior level of function, the stability of her condition, and her motivation to participate in therapy to return home independently. However, Johnston et al.[18] found that in a study of 72,824 patients who underwent various cardiac procedures, women were more likely than men to die within 30 days, one year, and during long term follow-up (median time five years, maximum time nine years). This study's authors did note that women only made up 24% of the study population and the women who presented for surgery "were older, more frail, and more medically complex than men"[18(p9)] and the study did not include open repair of EVAR of AAA. The patient was also receiving OT focusing on ADL training and was referred to a speech language pathologist (SLP) for a newly raised issue with her dentures, which was resolved quickly. No additional testing was needed; the outcomes assessed at the initial evaluation were to be re-assessed on the day of the next progress note and prior to the day of discharge. The patient received PT six days a week for approximately 45 to 60 minutes daily while in the SNF. The planned interventions included transfer training, gait training, stair training, balance activities, LE strengthening exercises and education regarding discharge planning and safety when returning home. The short and long-term goals were created based on the goals of the patient and are summarized in Table 4. The level of assist grades for the goals were assigned following the definitions in the Optima Healthcare Solutions (Optima Healthcare Solutions Alpharetta, GA) electronic medical record system. The goals were established based on the initial clinical impression, taking into account her diagnosis and age, prior to initial

testing. The patient's initial performance on the BBS surpassed the initial impression so the third short-term goal was immediately achieved. At the time of the patient's progress reassessment, additional goals were established based on her significant improvement that exceeded the initial clinical impression. The documentation system automatically set short-term goal dates for two weeks and long-term goal dates for one month; however, the patient's length of stay was later determined to be approximately two weeks based on her improvements with rehabilitation.

Intervention and Plan of Care

Coordination

Coordination between the OT, SLP, and nursing staff occurred throughout the patient's stay at the SNF. The scheduling of the patient for her various therapy services was coordinated in order to prevent the patient from receiving back-to-back treatments causing significant fatigue, which could impact her participation in therapy. The OT and PT also coordinated on what each therapy was addressing, with OT focusing on the upper extremities and ADL training and PT focusing on the LEs and functional activities.

Communication

The rehabilitation department, care coordinators and nursing communicated throughout the patient's care. An interdisciplinary team meeting between all departments mentioned above, as well as the patient and her family, was held 72 hours after admission. This meeting highlighted the focus of treatment and goals for each department and answered any questions from the family. It allowed for discharge planning among all stakeholders in the patient's care to begin as early as possible, and common goals to be established. Facility rounds were held weekly between the head of the rehabilitation department, nursing, and care coordination and any updates from these meetings were communicated to the therapist. Daily verbal communication with nursing

occurred prior to each session to discuss any changes in the patient's status overnight, and ensure the patient had been given her medications and was cleared to leave the unit for therapy. Daily notes and progress notes were documented in the electronic medial record.

Patient Education

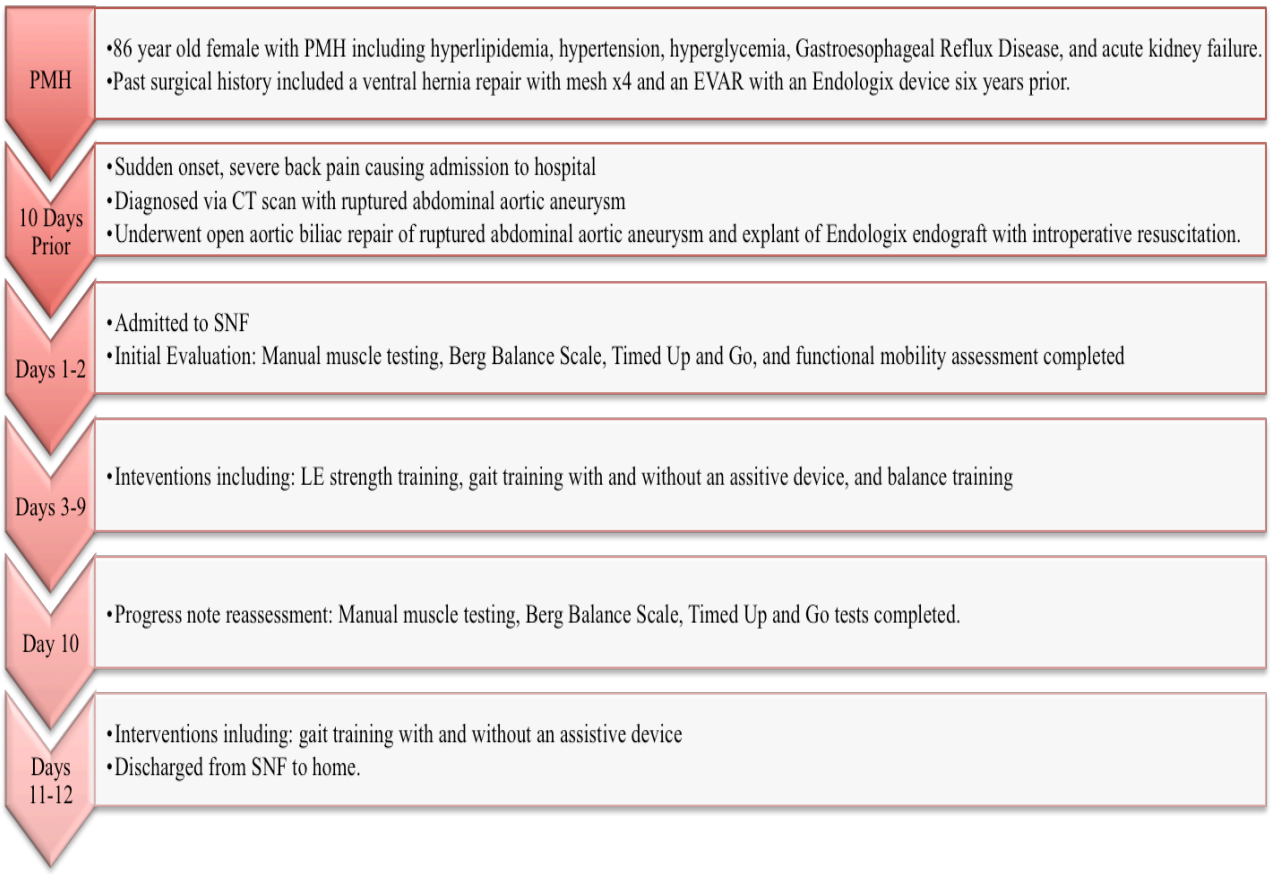
The patient was educated on her surgical precautions, which included no bending, twisting, strenuous activity, or lifting anything over ten pounds for two months. The patient was also provided education via verbal cues during gait training and stair training for proper mechanics. Significant emphasis was placed on educating about safety, especially when gait training without an assistive device. Understanding that she might feel weaker than before surgery and her endurance could be limited compared to her relatively high prior level of function was a daily topic of education.

Interventions

The daily interventions provided are summarized in Table 5, with specific intervention descriptions in Appendix 4. In the absence of specific recommendations for rehabilitation interventions following surgical repair of AAA, the therapist extrapolated this plan of care from that of elderly patients following coronary artery bypass graft (CABG) surgery. Interventions focused on gait training, stair training, LE strengthening exercises and balance activities in order to improve her tolerance for functional mobility and decrease her risk for falls. Busch et al.[19] found that elderly patients receiving cardiac rehabilitation plus resistance training and balance training status-post CABG showed significant improvements in walking distance, maximal relative workload and TUG times compared to those receiving cardiac rehabilitation alone. Additionally, Fulk et al.[20] suggest the use of both strengthening and standing balance training as complementary interventions to locomotor training. The Academy of Geriatric PT of the American PT Association recommends strength training, balance training and gait training as

interventions for community-dwelling older adults identified as being at risk for falls.[21] Based on the patients pre-morbid status and long term goal of returning home independently, this recommendation was used in the development of interventions, despite the patient not being community-dwelling at the time of admission to the SNF. Interventions were progressed based on the patient's tolerance at the previous session or by her presentation that day. Initially, sessions were focused on strength training in conjunction with mobility training. As her tolerance for activity improved the distance ambulated increased, as well as the difficulty of the task, such as ambulating without a walker or ambulating outdoors. The primary focus of the interventions was on improving her tolerance for ambulation and functional mobility in order to achieve her goal of returning home. The patient was compliant and attended all therapy sessions, including days when she was not feeling well, such as treatment day six. On day six the patient was nauseous and coughing and was unable to complete standing exercises so the session was regressed to accommodate her current condition. The BBS and the TUG were completed on treatment days two and eleven in order to collect initial and progress note/discharge summary data. The patient did not receive any co-interventions during this episode of care. See Appendix 5 for the timeline of the patient's entire plan of care.

Appendix 5. Timeline



Outcomes

The patient was seen for a total of 12 visits over the course of her stay at the SNF. The patient was compliant with the treatment plan and fully participated with all interventions. Even when she did feel sick on treatment day 6, she participated in activities at a lower level. The patient's tolerance was assessed throughout each session based on patient reported difficulty or pain, and the clinician's judgment. There were no adverse or unanticipated events during the course of her rehabilitation.

The patient improved her strength, dynamic balance and static balance, as evident by her improved scores on manual muscle testing, the TUG, and the BBS at the time of discharge, as summarized in Table 6. The patient's TUG score improved from 25.29 seconds to 16.75 seconds.

Marques et al.[22] found the minimal detectable change (MDC) on the TUG in older patients with Chronic Obstructive Pulmonary Disease (COPD) to be 2.68 seconds. In the absence of a TUG MDC for patients with AAA repair, the TUG MDC for individuals with COPD was used. Therefore, the patient displayed a statistically significant change from her initial evaluation to discharge with a change of 8.54 seconds. The patient's BBS score improved from 34/56 to 37/56. The MDC for the BBS is 6.3 points for elderly patients with an initial score of 25-34.[23] The patient did not display a statistically significant change in her BBS score, however, she displayed a trend towards improvement. Additionally, the patient was limited due to her surgical precautions and was unable to complete three of the 14 tasks in the BBS at both testing sessions. The patient's strength on MMT improved in all muscle groups, consistent with her ability to tolerate more difficult interventions throughout her plan of care. There were no important follow-up diagnostic test results completed.

Discussion

This case demonstrated the intended purpose as it described the PT plan of care for an elderly patient following an open repair of a ruptured AAA with a history of EVAR. The patient completed a plan of care comprised of strength, gait, and balance training in order to address her impairments in LE strength and static and dynamic balance. The patient displayed improvements in both LE strength and balance, as demonstrated by her improvements in MMT and TUG scores. Additionally, the patient consistently surpassed the initial clinical impression, and achieved all but two goals (see Table 4). These findings are consistent with the current literature that suggests using resistance training and balance training following cardiac surgery in elderly patients.[19]

One of the strengths of the approach to this case was the amount of one-on-one time available between the patient and therapist. No group sessions or co-treatments occurred during

the patient's episode of care, therefore, each treatment was uniquely designed for the patient's presentation and the goals the patient and therapist wanted to achieve in that session. A limitation to this case was the lack of follow-up after the patient was discharged. It is unknown if the patient was able to continue making improvements and if any adverse events occurred upon her return home.

In conclusion, strength training, balance training and gait training appeared to be successful PT interventions in the rehabilitation of a geriatric patient following open repair of ruptured AAA. The primary take-away lesson of this case report is PT interventions designed to address the specific impairments and goals of the patient following an open repair of ruptured AAA could potentially lead to improvements in both strength and balance. Due to the rarity of this specific patient case, particularly her age and significant medical and surgical history, large-scale studies are unlikely. However, with 200,000 people in the US alone being diagnosed with AAA each year, there is a substantial need for future research into the role of physical therapy for this patient population in general.[2] Moreover, the long-term functional outcomes after rehabilitation following surgical interventions for ruptured AAA could be a meaningful area of future research.

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Tables and Figures

Table 1. Summary of Abdominal Aortic Aneurysm Statistics

Number of AAA diagnosed each year in the United States	200,000[2]
Annual rupture risk by diameter	4-5 cm = 0.5-5%[4] >8 cm = 30-50%[4]
Mortality rate for ruptured AAA	80%[1]
Incidence of rupture following an EVAR	0.9%[5]
30-day mortality rate following repair of a ruptured EVAR	32%[5]

Abdominal aortic aneurysm (AAA), centimeters (cm), endovascular aneurysm repair (EVAR)

Table 2. Systems Review

Systems Review	
Cardiovascular/ Pulmonary	Impaired cardiovascular endurance Following the post-acute myocardial infarction protocol due to intraoperative resuscitation Vitals taken at rest: blood pressure 128/73 mmHg, heart rate 92 beats per minute, SpO2 98%
Musculoskeletal	Impaired gross strength in bilateral lower extremities, range of motion within functional limits bilaterally
Neuromuscular	Impaired static and dynamic standing balance
Integumentary	Healing abdominal incision with 44 staples, no signs of infection
Communication	Unimpaired
Affect, Cognition, Language, Learning Style	Unimpaired affect and cognition The patient's language is English and her preferred learning style is verbal and visual demonstrations

Table 3. Tests and Measures

Tests and Measures	**Initial Evaluation Results**	
Timed Up and Go	25.29 seconds, with a two wheeled walker (Medline Mundelein, IL) A score of >14 seconds indicates a high risk for falls.[14]	
Berg Balance Scale	34/56 A score of <45 indicates a greater risk for falls.[15]	
Manual Muscle Testing	Right LE: Hip Flexion 3/5 Hip Abduction 4-/5 Hip Adduction 4-/5 Knee Flexion 3+/5 Knee Extension 3+/5 Ankle Dorsiflexion 4-/5	Left LE: Hip Flexion 3/5 Hip Abduction 4-/5 Hip Adduction 4-/5 Knee Flexion 3+/5 Knee Extension 3+/5 Ankle Dorsiflexion 4-/5
Functional Mobility Assessment	Bed Mobility (supine to sitting, sitting to supine): Supervision Transfers (Bed to wheelchair, wheelchair to bed): Supervision Level Surfaces: Supervision, 75 feet with two wheeled walker	

	Uneven Surfaces: Did not test Gait Deviations: Forward trunk lean, decreased single limb support time, decreased stride length, decreased cadence

Lower extremity (LE), 3 (Fair), 3+ (Fair+), 4- (Good -).

Table 4. Short and Long-Term Goals

Short-Term Goals		
Initial Evaluation (RX Day 1)	**Progress Note (RX Day 10)**	**Discharge (RX Day 12)**
1. Patient will safely ambulate on level surfaces 175 feet using a two-wheeled walker with supervision with normal cadence and with a normalized gait pattern 85% of the time to facilitate increased participation in functional activity and return to prior living and supervision levels.	Goal Met New Goal: Patient will safely ambulate on level surfaces 300 feet using a two-wheeled walker with modified independence with normal cadence and with a normalized gait pattern 100% of the time to facilitate increased participation in functional activity and return to prior living and supervision levels.	Goal Met
2. Patient will safely perform functional transfers with modified independence without signs/symptoms of physical exertion and with the ability to right self to achieve/maintain balance in order to return to prior level of functional ability.	Goal Met	Goal Met
3. Patient will score a 30/56 on the Berg Balance Scale in order to improve her functional mobility and return to prior level of independence safely.	Goal Met	Goal Met
	4. Patient will safely ascend and descend 12 stairs with modified independence using handrails bilaterally with the ability to right self to achieve/maintain balance.	Goal Met
	5. Patient will ambulate 300 feet without an assistive device with supervision with normalized gait mechanics 100% of the time in order to return to prior level of function.	Goal Met
Long-Term Goals		
Initial Evaluation (RX Day 1)	**Progress Note (RX Day 10)**	**Discharge (RX Day 12)**
1. Patient will safely ambulate on level surfaces 500 feet using a two-wheeled walker with independence with normal	Continue	Discontinued Status at discharge:

cadence and with a normalized gait pattern 100% of the time to facilitate increased participation in functional activity and return to prior living and supervision levels.		modified independence
2. Patient will safely perform functional transfers with independence without signs/symptoms of physical exertion and with the ability to right self to achieve/maintain balance in order to return to prior level of functional ability.	Goal Met	Goal Met
3. Patient will score a 45/56 on the Berg Balance Scale in order to improve her functional mobility and return to prior level of independence safely.	Discontinued Status at Progress note: 37/56	Discontinued

RX (Treatment)

401 **Table 5. Interventions**

	RX Day 1	RX Day 2	RX Day 3	RX Day 4	RX Day 5	RX Day 6	RX Day 7	RX Day 8	RX Day 9	RX Day 10	RX Day 11	RX Day 12
Therapeutic Exercise	Seated hip flexion 15 reps x 1 set, and seated LAQ 10 reps x 2 sets		Seated, 15 reps x 2 sets each, including: hip flexion, LAQ, heel raises, hip ABD with blue Theraband* (TheraBand Akron, OH), and hamstring curls with blue Theraband* Anterior step ups to 3" step in parallel bars w/ BUE support	Standing, 10 reps x 2 sets each, w/ BUE support in parallel bars including: heel raises, hip flexion, hip ABD		Supine, 10 reps x 2 sets each including: ankle pumps, heel slides, hip ABD/ADD, SAQ, pelvic tilts Supine scooting in bed for improved bed mobility						
Gait Training		Ambulated 200' w/ 2WW SPV	Ambulated 200' x 3 w/ 2WW, SPV	Ambulated 400' w/ 2WW, SPV	Ambulated 400' w/ 2WW, SPV		Ascended and descended 3 steps w/ UUE on rail, SPV, 3 sets Ambulated 200' inside on carpet w/ 2WW, SPV Ambulated 500' outside on pavement w/ 2WW, SPV Ambulated 5' in parallel bars w/o UE support, SPV	Ascended and descended 3 steps w/ UUE on rail, SPV, 3 sets Ambulated 30' x 4 sets w/o 2WW, CGA, seated or standing rest breaks between sets Ambulated 250' w/ 2WW, SPV	Ascended and descended 3 steps w/ UUE on rail, SPV, 2 sets Ambulated 75' x 3 sets w/o 2WW, SBA Ambulated 200' w/ 2WW, SPV	Ambulated 150' x 2 sets w/ 2WW, SPV Ambulated 125' w/o 2WW, SPV Ascended and descended 3 steps w/ UUE on rail, SPV, 4 sets	Ambulated 250' w/ 2WW, SPV Ambulated 60' x 5 sets w/o 2WW, SPV, with standing rest breaks as needed Ascended and descended 5 steps w/ UUE on rail, SPV, 5 sets	Ambulated 500' w/ 2WW, MI Ambulated 300' w/o 2WW, SPV Ascended and descended 3 steps w/ UUE on rail, SPV, 4 sets
Therapeutic Activity		BBS completed. TUG completed. Toilet Transfer w/ 2WW, cueing and min A for hand placement on grab bars and reaching outside BOS for clothing.		Standing balance in staggered stance w/o UE support in parallel bars, 30 second holds x 2 each leg forward	Dynamic standing balance including normal stance to single leg stance w/ UE support 1-3 count hold x 10 reps each LE x 4 sets Single leg toe taps to 3" step x 5 reps x 2 sets each LE w/o UE support Alternating toe taps to 3" step x 10 reps w/o UE support			Standing dynamic balance reaching outside BOS at Dynavision D2 (Dynavision Palatine, IL) w/ rings 3,4,5 and no UE support, 2 minutes x 2 sets	Stepping anteriorly and laterally over 4 dowels on the ground 8" apart, 5 reps each direction w/ UUE on parallel bars SCIFIT Recumbant Stepper (SCIFIT Systems Inc. Tulsa, OK) for 2 minutes, discontinued due to discomfort at incision	BBS and TUG completed for progress note and discharge summary.		

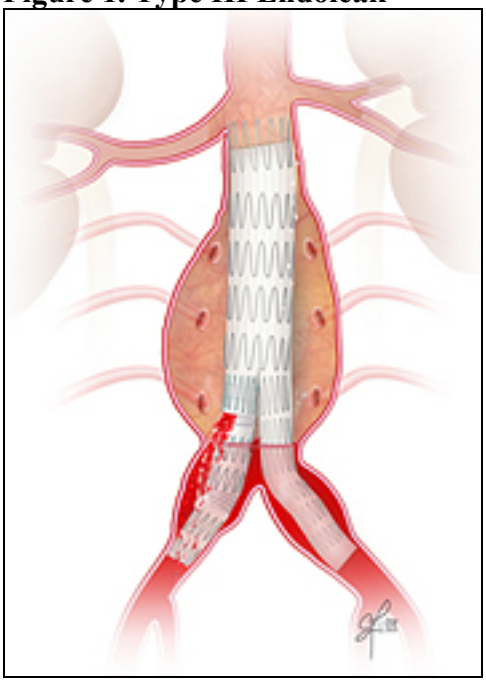
Repetitions (reps), long arc quad (LAQ), with (w/), two-wheeled walker (2WW), supervision (SPV), minimal assistance (min A), base of support (BOS), abduction (ABD), bilateral upper extremity (BUE), adduction (ADD), short arc quad (SAQ), without (w/o), unilateral upper extremity (UUE), contact guard assist (CGA), stand by assist (SBA), modified independence (MI)
*Blue TheraBand (TheraBand Akron, OH) resistance in pounds at 100% elongation = 5.8.

Table 6. Outcome Measures

Test	Initial Evaluation	Discharge
Manual Muscle Testing		
Hip flexion	3/5	4-/5
Hip abduction	4-/5	4+/5
Hip adduction	4-/5	4+/5
Knee flexion	3+/5	4+/5
Knee extension	3+/5	4+/5
Ankle dorsiflexion	4-/5	4/5
Timed Up and Go	25.29 seconds	16.75 seconds
Berg Balance Scale	34/56	37/56

3 (Fair), 3+ (Fair +), 4- (Good -), 4 (Good), 4+ (Good +)

Figure 1. Type III Endoleak



Reprinted from Cleveland Clinic, 2019.[24]

Appendices

Appendix 1. Medications

Medication	Dosage	Indication
Omeprazde 40 MG capsule delayed release	Take 1 capsule (40 MG total) by mouth daily.	GERD
Oxycodone 5 MG tablet	Take 1 tablet (5 MG total) by mouth every 4 hours as needed for pain.	Pain management
Aspirin 81 MG tablet delayed response	Take 1 tablet (81 MG total) by mouth daily.	Blood thinner

Lactobacillus Pack	Take 1 packet by mouth 3 times daily.	Probiotic
Cholecalciferol 1000 units tablet	Take 1,000 units by mouth daily	Vitamin D deficiency
Cyanocobalamin 1000 MCG tablet	Take 1,000 MCG by mouth daily	Vitamin B12 deficiency
Acetaminophen 325 MG tablet	Take 2 tables by mouth every 6 hours needed for pain	Pain management
Simvastin 20 MG tablet	Take 20 MG by mouth every evening	Hyperlipidemia

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412 **Appendix 2. Berg Balance Scale[25]**

1. SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hand for support.
( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or stabilize
( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding on.
( ) 4 able to stand safely for 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL
INSTRUCTIONS: Please sit with arms folded for 2 minutes.
( ) 4 able to sit safely and securely for 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING
INSTRUCTIONS: Please sit down.
( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assist to sit

5. TRANSFERS
INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.
( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cuing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays safely
( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER
INSTRUCTIONS: Place your feet together and stand without holding on.
( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
( ) 4 can reach forward confidently 25 cm (10 inches)
( ) 3 can reach forward 12 cm (5 inches)
( ) 2 can reach forward 5 cm (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper, which is place in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.
( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cuing
( ) 0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.
( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in > 20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete > 2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)
( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

14. STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding on.
( ) 4 able to lift leg independently and hold > 10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds

( ) 2 able to lift leg independently and hold ≥ 3 seconds ( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently. ( ) 0 unable to try of needs assist to prevent fall

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414 **Appendix 3. Medical ICD-10 Codes**

I71.3	*Abdominal aortic aneurysm, ruptured*
I10	*Essential (primary) hypertension*
K21.9	*Gastro-esophageal reflux disease without esophagitis*
D50.0	*Iron deficiency anemia secondary to blood loss (chronic)*
E78.5	*Hyperlipidemia, unspecified*
E80.6	*Other disorders of bilirubin metabolism*
M15.0	*Primary generalized (osteo)arthritis*
R57.1	*Hypovolemic shock*

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416 **Appendix 4. Specific Intervention Definitions**

Intervention	**Definition**
Hip flexion	In a seated or standing position, ask the patient to raise one of their knees up as if to bring it to their chest and slowly lower it down to the original position.
Long arc quad (LAQ)	In a seated position, ask the patient to extend one of their knees out in front of them and then slowly lower it down to the original position.
Heel raises	In a seated or standing position, ask the patient to rise up on their toes and then slowly lower their heels down.
Seated hip abduction	In a seated position with feet together, tie a Theraband above the knees of the patient. Ask the patient to open their knees up away from one another, keeping the feet on the floor, and then return their knees to the starting position
Seated hamstring curl	In a seated position with one knee almost fully extended, wrap a Therband around one ankle with the therapist holding the ends of the band, ask the patient to bend their knee back and then slowly return it to the extended position.
Standing hip abduction	In a standing position, ask the patient to lift one leg out to the side, keeping their toes and pelvis facing straight ahead, and then slowly lower leg back down.
Ankle pumps	With the patient lying on their back, ask the patient to pump the feet up towards the ceiling and then point them down as far as they can going through their full range of motion available.
Heel slides	With the patient lying on their back, ask the patient to bend one knee and slide their heel up as far as they can and then slowly extend their knee and slide the heel back down.
Short arc quad (SAQ)	With the patient lying on their back and a large towel roll under one knee, ask the patient to extend their knee completely and then slowly bend their knee back down to the starting position.
Supine hip ABD/ADD	With the patient lying on their back and keeping their knee straight, ask the patient to slide their leg out to the side, keeping their toes up towards the ceiling, and then slowly slide the leg back in to the starting position.

Pelvic tilts	With the patient lying on their back and knees bent, ask the patient draw their belly button in and tuck their tailbone, pause, and then relax.
Supine scooting in bed	With the patient lying on their back and knees bent, ask the patient to raise their hips up and move them to the left or right, in order to adjust their position in bed and improve their bed mobility skills.

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418 **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.	3
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. **Clinical Findings** – Relevant physical examination (PE) and other clinical findings	6
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
9. **Therapeutic Intervention** a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	9
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.	11
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.	12

d. The primary "take-away" lessons from this case report.	
12. **Patient Perspective** – The patient can share their perspective on their case.	5
13. **Informed Consent** – The patient should give informed consent.	4