5-2020

Outpatient Physical Therapy Management of a Patient with Tibia Fracture and Secondary Normal Pressure Hydrocephalus -- A Case Report

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Outpatient Physical Therapy Management Of A Patient With Tibia Fracture And Secondary Normal Pressure Hydrocephalus – A Case Report

by

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B.S. Degree Wildlife Biology
Dickinson State University May, 2013

A Scholarly Project Submitted to the Graduate Faculty of the
Department of Physical Therapy
School of Medicine
University of North Dakota

In partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota
May, 2020

This Scholarly Project, submitted by Kevin Hansen in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)

(Chairperson, Physical Therapy)

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ACKNOWLEDGEMENTS

I would like to thank the faculty of the University of North Dakota physical therapy department, and my classmates for the continual support, guidance, and proofreading for the preparation of this case report. I would also like to thank my clinical instructor and the patient in this case report for giving me approval to collect data, and the opportunity gain this experience as a student physical therapist.

ABSTRACT

Background and Purpose:

Falls are a major health care concern for the older adult. Injuries related to falls in the geriatric population are not uncommon. Furthermore, individuals with brain disorders are going to be even more susceptible to falls. The purpose of this study was to examine the outpatient physical therapy (PT) rehabilitation of a patient who fell and sustained a right tibial fracture with a past medical history of a brain disorder.

Case Description:

This case report describes the outpatient PT management of a patient who presented with a right tibia shaft fracture, post-operative right tibia intramedullary nailing and secondary complications of normal pressure hydrocephalus (NPH). Treatment diagnosis included decreased range of motion/mobility, balance/stability, functional movement patterns, performance and tolerance of activities of daily living, and ability to self-manage condition. Patient also had fall risk/safety concerns.

Interventions:

The plan of care for this patient consisted of a mix of interventions that were progressed throughout the course of treatment. Interventions included gait training, therapeutic exercise for functional strengthening, endurance, stair training, patient and family education, neuro re-education, and balance.

Outcomes:

Patient was seen for 10 weeks for a total of 17 PT sessions. Patient met all of his goals and increased his lower extremity functional scale (LEFS) score by 23 points from initial evaluation to discharge. At discharge, the patient was at prior level of function but had remaining deficits in balance and gait due to his history of NPH.

Discussion:

The patient could have benefitted from continued PT services to continue to improve his balance and gait, but was limited in physical therapy sessions due to the Medicare therapy cap. The patient made clinically significant gains in the LEFS, met all of his goals, and was at his prior level of function. However, the LEFS was used as the sole functional assessment of this patient. The LEFS does not assess quality of life or predict risk of falls. Since this patient was at a high risk for falls, this case report could have benefitted from an assessment to measure balance and risk of falls.

Key words: Tibia shaft fracture, tibia intramedullary nailing, Normal pressure hydrocephalus, Lower Extremity Functional Scale (LEFS)

CHAPTER 1

Background and Purpose

Falls among the geriatric population are of great concern to the health care system and are often a fear to these patients, thus limiting quality of life. In general, as we age, we become more susceptible to falls due to the natural biological process of deteriorating sensory, cognitive, and musculoskeletal changes.[1] There is an associated high cost of healthcare related to injuries due to falls. The estimated total healthcare expenditures in the US for nonfatal falls among individuals over the age of 65 was more than $49.5 billion in 2015.[2] There are many different factors that can contribute to an increased risk for falls, with gait and balance disorders being a high indicator.[3,4] However, exercise programs have the ability to reduce the risk of falls in the older population.[5] Interventions targeted on balance, gait, muscle strength, and functional exercises can help to prevent falls in this population.[6] The older population that has endured an acute lower extremity (LE) injury such as a fracture and also has a past medical diagnosis that affects cognition, balance, and gait are going to be even more susceptible to recurrent falls and injury. However, there is limited research on the rehabilitation of patients who have undergone orthopedic LE surgery with a secondary brain disorder such as normal pressure hydrocephalus (NPH). The purpose of this case report is to describe the physical therapy management of an older adult who had a fall and suffered a right tibia fracture, post-operative intramedullary nailing, and had been previously diagnosed with NPH. (See Figure 1)

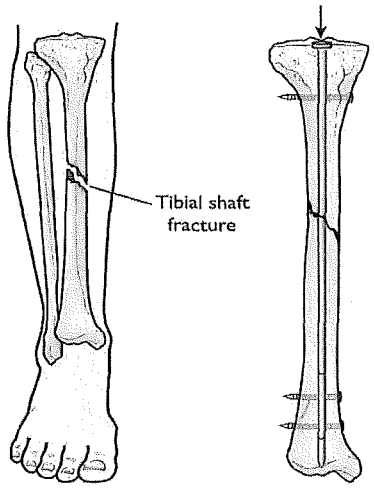

Figure 1. Tibia Shaft Fracture with IMN fixation[17]

Reprinted from: https://orthoinfo.aaos.org/en/diseases--conditions/tibia-shinbone-shaft-fractures/

NPH is an enlargement of the brain's ventricles, due to a build-up of cerebrospinal fluid, that affects brain function and can cause mental impairment. This brain disorder can be congenital of acquired after injury to the brain.[7] Among adults, with an average onset at 70 years of age, idiopathic NPH is the most common form of hydrocephalus.[8] Diagnosis may be difficult as symptoms of dementia, problems with walking, and impaired bladder control are similar to Alzheimer's and Parkinson disease (PD). Similarly to PD, individuals with NPH present with a shuffling gait pattern. With impairments of balance, gait and bladder control that is more prevalent at night, individuals are at a high fall risk. Although there is no cure for hydrocephalus, an effective treatment includes a cerebral spinal fluid shunt surgery. However, it has been shown that exercise can be effective for increasing cognitive function and ADLs in those with dementia.[7] Furthermore, exercise and motor training has been shown to improve balance and mobility in individuals with PD.[9,10] Therefore, exercise and motor training may show carryover for improving cognitive function and functional mobility in those with NPH.

Tibial shaft fractures are one of the most common long bone fractures in the United States.[11,12,13] Fractures may cause pain, stiffness, swelling, weakness, and decrease functional mobility.[14] If fractures are unable to heal suitably with conservative treatment, surgery may be indicated. A standard surgical procedure for tibial shaft fractures includes intramedullary nailing (IMN).[11] The IMN procedure consists of re-aligning the tibia shaft and placing a metal rod (nail) into the medullary space of the bone and securing the rod in place with the use of proximal and distal tibial shaft screws. IMN is used to stabilize, strengthen, and promote correct alignment for proper healing of the tibia. This surgical procedure is beneficial for early postoperative rehabilitation as patients may be weightbearing as tolerated on the affected limb immediately following the procedure. Early weight bearing is important and may have advantages for faster recovery and to prevent muscle atrophy.[11] Postoperative rehabilitation following tibial shaft surgery is crucial for individuals and will help patients return to their prior level of function (PLOF) as soon as possible. (See Figure 2.)

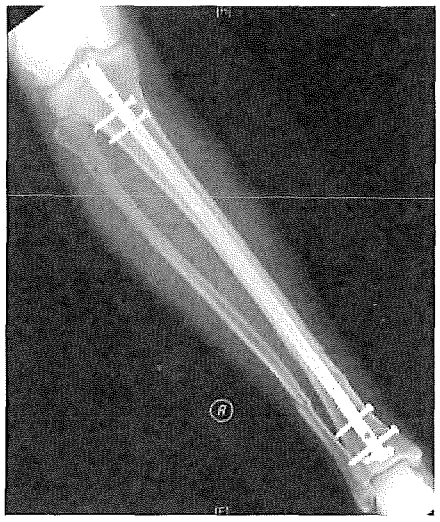

Figure 2. Radiograph of Right Tibia Fracture with IMN fixation[18]

Reprinted from: https://www.orthobullets.com/trauma/1045/tibia-shaft-fractures

The lower extremity functional scale (LEFS) is a widely used functional assessment tool used by physical therapists for any LE impairment.[15,16] The LEFS was used in this case report to assess initial function, ongoing progress, and outcomes of therapeutic treatment. The LEFS is a self-reported questionnaire consisting of 20 questions that are scored on a 0 to 4 scale ranging from extreme difficulty or unable to perform activity (0/4), to no difficulty at all (4/4). Questions are narrowed down to assess essential functional mobility components such as ability to perform activities of daily living, sitting, standing, walking, and running. The total possible score is 80 and higher scores on the scale indicate an advanced functional ability. The minimal detectable change on LEFS is equal to or greater than 9 points. The LEFS is reliable, valid, and sensitive to change in patients with LE musculoskeletal dysfunctions.[15,16]

Within this case we will examine how a patient who sustained a right tibial fracture with a past medical history of a brain disorder affected the physical therapy management and plan of care. This study will explore the outpatient physical therapy rehabilitation interventions and outcomes of a post-operative right tibia IMN patient with a comorbidity of NPH. The intent of this case report is to provide useful information for future physical therapy management of patients with similar presentations.

CHAPTER II

Case Description

The patient was a 66-year-old male presenting to outpatient physical therapy sixteen days post right tibia IMN surgery, following a traumatic right tibia fracture. While the patient and his wife were lifting and moving a large television, they lost control and the television fell onto the patient's leg. He sustained a right tibial fracture that required surgery for repair. The surgery required an IMN procedure of the right tibial shaft to repair and realign the fracture and strengthen the bone. The patient was referred to physical therapy for right LE strengthening, knee and ankle ROM, gait training, and use of modalities as needed. The patient had no precautions and was weightbearing as tolerated.

The patient's chief complaint was pain in the right lower leg, and the inability to bear weight through the right LE. Rest and Acetaminophen were the only things that helped to alleviate the pain. Due to the injury, the patient had difficulty sleeping at night and used a wheelchair for locomotion which was challenging to maneuver around his home. Prior to the injury, the patient was independent with the use of a 4-wheeled walker and could complete all activities of daily living. He had been previously diagnosed with NPH and reported symptomology of poor balance and memory. The patient was at a high fall risk, having had three falls in the past year. Other medical history included: diabetes, high blood pressure, heart disease, and dizziness. The patient took medication to control blood pressure, diabetes and cholesterol.

The patient was retired and lived with wife, and their main goal for physical therapy was to restore functional mobility to prior level of function before the injury. Another goal for the patient was to reduce the burden on his wife as the caretaker and to be able to spend time with his grandchildren. More immediate goals for the patient were to decrease pain and improve weight bearing onto the right lower extremity. This would allow the patient to stand for longer periods of time, making it easier for transfers and ability to reach items in standing. Also, being able to ambulate short distances with use of his 4-wheeled walker was important for the patient to be able to get around his house independently.

Examination and evaluation was based off White's musculoskeletal examination.[19] This musculoskeletal examination allows for the ability to identify impairments and activity limitations involving muscles, bones, and joints. It also identifies risk factors for re-injury or worsening of conditions, and the need of appropriate and necessary assistive devices. We were able to find the baseline data of the patient through detailed history taking and review of the medical chart. Observation, assessment of motor function and sensory integrity, ROM, and palpation were performed. Once evaluated we were then able to develop goals, make a prognosis, formulate expected outcomes, and create a plan of care.[19]

The patient reported that pain in his right lower leg was currently 3/10 at rest and 9/10 when weight bearing, according to the visual analog scale (0/10 = no pain, 10/10 = unbearable pain). Upon observation, the patient was using a wheelchair (w/c) for transportation. Steri-strips were still in place over the incision and no signs of infection were present. He had difficulty with transitioning from the w/c to the plinth table using a stand-pivot transfer with stand-by assist. The patient demonstrated heavy weight shifting off affected side during sit-to-stand transfers and with standing. ROM was within normal limits for all planes of motions in his knee and ankle

bilaterally. However, he noted minimal pain with ankle eversion. Manual muscle tests and special tests were deferred secondary to surgery and placing stress across tibia. Patient was tender to palpation over incisions, along tibial shaft and gastrocnemius. The patient scored 8/80 on the LEFS; having extreme difficulty with walking, squatting, lifting objects, performing light activities around home, standing for one hour, and navigating stairs.

The patient was appropriate for PT and would benefit from PT services by decreasing pain, normalizing weight bearing status, increasing balance and LE strength, improving ambulation, and functional mobility. The patient's plan of care (POC) was to be seen two days a week for one-hour long sessions, for ten weeks. The patient demonstrated good understanding of the PT program and current condition and agreed with the POC. The patient's prognosis was good, as long as he followed the recommended POC. Some barriers that he would have to overcome included having a medical history of NPH, thus decreasing the patient's balance, gait pattern, and memory. Furthermore, the patient was retired and lived a non-active lifestyle which affected his endurance and strength. However, the patient was motivated and committed to return to prior level of function and was well supported by his wife.

CHAPTER III

Intervention

Interventions began on the first day of physical therapy, sixteen days post-operation. The initial focus was on decreasing pain, increasing right LE weightbearing tolerance, and educating patient on self-care for home life. Interventions would then advance to target balance, gait training, and LE strengthening to improve functional mobility and decrease risk of falls. Interventions were based off of Kinser and Colby's therapeutic exercises and progression.[20] Each therapy session incorporated a mix of interventions which depended on how the patient was feeling that day and how the patient responded to the previous session. If the patient responded well and was feeling good, slow progressions were made. If the patient had an increase in pain and reported being tired from not sleeping well, exercises stayed the same or intensity was decreased, and the patient was allowed to have more rest breaks during the session.

Self-care education on safe mobility, and pain and swelling management was given based off the principles of PRICE (Protect, Rest, Ice, Compression, Elevate).[21] To aid in attention and ability to stay focused on the task, the patient started therapy in a closed and quiet environment (examination room) for the first two weeks of therapy. The patient eventually progressed to an open environment (PT gym with music and other patients) for the remainder of treatment. Interventions started with light isometric and isotonic exercises and progressed to higher level balance activities and gait training. Exercises started in the supine and seated position for the first two weeks and would progress to static standing exercises in the parallel bars, advancing to

dynamic standing activities in the later weeks of therapy. Every physical therapy session began with a 10 min warm-up on the Nu-step machine. This allowed for improved endurance as well as increasing weightbearing force through right LE, increasing LE strength, and maintaining LE ROM. Patient initially started at level 1 on the Nu-step with the use of arms and legs. The patient would progress the level of resistance on the Nu-step weekly, and eventually only used his legs to propel the Nu-step machine. By the last few weeks of treatment, the patients would complete 10 minutes on the Nu-step machine at a level of 7 with use of bilateral LE's only.

For the first two weeks, the patient completed ankle ROM in all four planes with resistance applied using a TheraBand. Ankle ROM and neuromuscular education was also worked on with the use of a wobble board. To improve weightbearing of right LE, short isometric presses into a bosu-ball in the sitting position, and supine leg extensions into a physio-ball were completed. The patient also completed supine bridges to aid in right LE weightbearing, and LE and core strength. Weightbearing exercises for post-operative fractures has many benefits such as improved bone healing, decreased risk of deep vein thrombosis, and a quicker recovery to PLOF.[22,23,24] The patient was given a home exercise program (HEP) to be completed twice a day that included 4-way ankle with resistance band, seated foot presses into foam pad, and supine bridges. In the second week, standing exercises were added to initial treatments. In the parallel bars, the patient performed small lunges, pressing into a bosu-ball with the lead foot, and standing weight shifts with handheld support. Practice of static standing without handheld support was incorporated. During static standing, tactile and visual cues were used to promote no weight shift and proper alignment. Short ambulation distances with the use of a 4-wheeled walker was also introduced. Refer to Table 1 for complete description of exercises.

Table 1. Interventions for the first two weeks

Exercise	Description	Frequency, Duration
Ankle 4 way	Patient in long seated position, with foot off surface for free ankle movement	2 sets of 10 reps in each direction (plantarflexion, dorsiflexion, inversion, eversion). Resistance applied with TheraBand, increase resistance as tolerated
Wobble board	Patient in seated position, one foot plated on floor and one foot placed in center on wobble board	2 sets of 10 reps in each direction (plantarflexion, dorsiflexion, inversion, eversion)
Bosu Seated press	Patient in seated position, one foot planted on floor and one foot placed in center of Bosu ball. Patient presses targeted leg into Bosu ball	2 sets of 10 reps with 5 sec isometric hold
Bridges	Patient in supine position with knees bent to 90 degrees, shoulder width apart. Patient pushes through feet on flat surface to raise pelvis to neutral position and slowly returns pelvis to mat	2 sets of 15 reps. May add isometric holds with pelvis in neutral position as tolerated and/or add resistive TheraBand around patients' knees
Supine leg extension into PB	Patient in supine position with targeted leg in 90/90 position with foot placed in center of Physio ball. PT holds Physio ball while patient presses into extension	2 sets of 10 reps. May add isometric holds
Bosu ball Lunges	Standing in parallel bars, patient lunges forward onto bosu ball and returns to neutral standing position	2 sets of 10 reps. Parallel bar handheld assist. May add isometric lunge holds

In weeks three through five, the patient continued to progress in previous interventions (reps, time, resistance) and would advance in balance, strength, and functional activities. Improving standing exercise tolerance, ambulation distance, and gait form with the use of a 4-wheeled walker was targeted at this point. Exercises added to interventions included sit-to-stand transfers, seated marches, standing marches, calf raises, step-ups onto raised platforms in the parallel bars, and stair training. Step-ups started with use of a two-inch platform and increased to six inches. Weight shifts in the parallel bars, with hand-touch support only when needed, was completed on a foam pad. During gait training with a 4-wheeled walker, the patient showed a shuffling gait pattern augmented by a history of NPH and worsened by fatigue and pain. The

patient could temporarily correct his gait pattern with consistent verbal cues to slow down and take larger steps. To aid in step length and height along with exercises mentioned above, the patient would be cued by having to step on colored dots within normal step length (28 inches) and over objects in the parallel bars to promote proper stepping biomechanics.[25] Refer to Table 2 for complete description of added exercises.

Table 2. Interventions added to the first two weeks

Exercise	Description	Frequency, Duration
Sit-to-Stands	Patient in seated position with both feet planted on floor, hips and knees in ~90 degrees on flexion. Patients stands and slowly descends back to seated position	2 sets of 10 reps
Calf Raises	Patient standing in parallel bars, both feet used to raise heels off floor and back to neutral position	2 sets of 10 reps. Parallel bar hand touch assist.
Seated Marches	Patient sitting of foam pad or bosu ball with both feet on the floor. Patient slowly alternates lifting knees as high as able.	2 sets of 10 reps. Progress by adding ankle weights.
Standing Marches	Patient standing in parallel bars, slowly alternates lifting knee to 90 degrees of hip flexion	2 sets of 10 reps. Parallel bar hand touch assist as needed. Progress by adding ankle weights.
Static Standing on Foam Pad	Patient stands on foam pad in parallel bars.	4 sets of 30 seconds. Parallel bar hand touch assist as needed. Progressed time to 1 min. Added horizontal and vertical head turns.
Step-ups	Patient standing in parallel bars, steps up onto raised platform alternating leading leg	2 sets of 10. Parallel bar hand touch assist as needed. Progress by increasing height of step and by stepping off and on to foam pad
Side step-up	Patient standing parallel to one side of parallel bars, steps sideways onto raised platform and off platform on opposite side. Patient sidesteps up and over raised platform, going back and forth	2 sets of 10. Parallel bar hand touch assist as needed. Progress by increasing height of step and by stepping off and on to foam pad

By week five, the patient was able to ambulate 140 feet, with a 4 wheeled walker, throughout a PT session. During ambulation bouts, the patient would start with a proper gait pattern but would return to a shuffling gait pattern after 30 to 40 feet. A current goal at this time

for the patient and wife was to overcome eight stairs with the use of one railing available, so that they would be able to meet with their accountant. Therefore, stair training and education was completed. The patient was able to ascend and descend twelve stairs with the use of one handrail and handheld assist by the wife.

From weeks five through ten, exercises continued to progress, and ambulation distance continued to increase. Balance and strengthening activities were advanced to static standing on a foam pad with head turns and completing forward/backward and lateral step-ups to an eight-inch platform, on and off a foam pad. The patient began ambulating while pushing a weighted sled (similar to pushing a lawn mower or grocery cart). Gait training with the use of a quad cane was introduced. The patient was able to use proper gait form for up to 65 feet before losing focus and coordination. A quad cane was trialed for two more sessions, but ambulation was not improving. We communicated with the patient and wife about other assistive device options to improve gait. The patient thought that he could do better with walking sticks because of a past hobby of skiing. We encouraged the use of walking sticks as it can help improve overall gait, balance, stability, and decrease the risk of having a fall.[26] Walking sticks are also much lighter than many other assistive devices such as a walker and would be more convenient for this patient. The patient was able to walk a greater distance (225ft) with proper gait form using the walking sticks. We worked on gait with walking sticks for the remainder of PT sessions. Single leg balance was also worked on and patient was able to hold for short periods of time requiring many hand touches to parallel bars.

Due to the Medicare cap on PT sessions, the patient's last treatment session occurred after a two-week period without PT so that the patient had increased time to evaluate self and home life and come prepared with questions before making decision to be discharged. The last

session focused on gait with use of walking sticks, forward and backward sled push/pull, sit-to-stands, and patient performed 5 mini hops in parallel bars. Education on HEP and best option for AD use during different situations and environments was provided. The patient was safe to use walking sticks in more predictable, safe, and even ground environments. Everywhere else, uneven/icy ground and crowded environments, the patient was advised to use 4-wheeled walker for increased support and balance.

CHAPTER IV

Outcomes

The patient received physical therapy for ten weeks, completing a total of seventeen physical therapy sessions. At initial evaluation, the patient scored an 8/80 on the LEFS. The patient had extreme difficulty with walking, squatting, lifting objects, performing light activities around home, standing for 1 hour, and navigating stairs. His resting pain was 3/10 and increased to 9/10 when weight bearing. After four weeks of therapy, the patients LEFS increased to 15/80. The patient was having less difficulty walking between rooms, squatting and picking up light objects from the floor, performing light activities around home, getting in and out of car, and standing for 1 hour. For the LEFS, an increase in 6 or more points indicates a true change and an increase in 9 or more points reflects a clinically meaningful change.[15,16] After 4 weeks of physical therapy, the patient increased his LEFS score by 7 points, indicating that the patient was making a true change in his functional mobility.

At discharge, the patient scored 31/80 on the LEFS. The patient made great improvements by showing an increase of 23 points on the LEFS from the initial evaluation, and an increase of 16 points on his LEFS score since the four-week mark. The patient met all of his goals, his pain was 0/10 using the VAS, and he reported to be back to his PLOF before the injury. He was able to successfully go on a vacation, via airplane, with his family and was satisfied with his physical therapy treatment. The patient opted to be discharged due to meeting the Medicare cap. The patient could have benefited from continued PT services to improve

balance and gait, which were still impaired due to his preexisting condition of NPH. However, the patient began with ambulating 40ft with the use of a 4 wheeled walker at the beginning weeks of physical therapy and improved to ambulating 225ft using bilateral walking sticks. Overall, the patient significantly improved his functional mobility and quality of life. Refer to Table 3 for outcomes.

Table 3. Outcomes

	Initial Visit	**At Discharge**
LEFS	8/80	31/80
Pain	Reported 3/10 at rest and 9/10 when weight bearing using the VAS	Reported 0/10 at all times using the VAS
Ambulation	Used Wheelchair for mobility	225ft with use of bilateral walking sticks. Independent with 4-wheeled walker (patients PLOF). Patient able to ascend/descend 12 stairs with one handrail and SBA.

CHAPTER V

Discussion

This case report describes the physical therapy management of a post-operative patient receiving an IMN surgery to the right tibia. The patient had a successful orthopedic recovery, meeting all of his goals and returning to his pre-injury level of function. The patient was seen for a total of ten weeks, a physical therapy duration that may have been longer than a typical outpatient orthopedic patient with the same condition without comorbidities. Since the patient had been diagnosed with NPH, this provided challenges to therapeutic interventions and required a slower progression. The patient improved his LEFS by 23 points from initial evaluation until discharge. The LEFS assessment shows that this patient made clinically meaningful functional change well over the cut-off point of 9 points.[15,16] However, due to his condition of NPH, the patient still had balance and gait impairments and could have benefitted from continued physical therapy services. The patient had met his cap on Medicare physical therapy visits and would therefore be discharged from physical therapy with a HEP, instead of having to pay out of pocket expenses of continued physical therapy services. The patient was well educated on the use of different assistive devices for different environments and on reducing his risk for falls.

The initial primary goals for the patient were to have no pain and to be able to bear full weight through his R lower extremity. The patient accomplished these goals as demonstrated with gait training, balance exercises such as single leg stance, performing 5 mini hops, and having no pain for many weeks before being discharged. The most satisfying accomplishment to

the patient was his drastic change in functional mobility. He went from getting manually pushed in a wheelchair to ambulating 225ft with the use of bilateral walking sticks. The patient was also comfortable ambulating with his 4-wheeled walker in more difficult or distracting environments. Although the patient made significant improvements, the patient was still at a high risk for falls due to his condition of NPH and history of falls.

This case report is limited in that an assessment to more specifically measure the patient's risk for a fall was not completed. A functional assessment for determining the risk of fall could have been beneficial for this case. The Mini-BESTest could have been a viable option as it has been proven to be accurate for predicting falls among older adults.[27] Future research should focus on using the combination of the LEFS with an additional functional assessment to predict the risk of a fall on the management of an older outpatient orthopedic patient with a LE musculoskeletal injury and a secondary brain disorder.

There is limited research on effective physical therapy rehabilitation for outpatient orthopedic patients with brain disorders, and even more so for patients with NPH. NPH, like many other brain disorders causes mental impairment, dementia, problems with walking, and impaired bladder control.[7] The patient also had fallen 3 times within the last year. Therefore, the patient required close supervision at all times. Because of these factors, progression was slower than usual, and the patient required consistent verbal, visual, and tactile cues throughout exercises. However, despite being a medically complex patient, the patient was able to return to PLOF through a physical therapy POC consisting of balance, strengthening, gait training, and functional exercises. The patient benefited himself by being compliant to physical therapy sessions, showing motivation to improve, and being well supported by his wife. This case report

can provide useful information for treating orthopedic post-operative patients with secondary brain disorders.

Reflective Practice

I think our clinical experiences are key for building real life practice with patients. It gives us the opportunity to put together everything we have learned and use it in a practical way and gives us experience to build upon. I found this case report to be unique in its complexity, treating a patient for post-operative rehabilitation but also having to take into consideration past medical history of a brain disorder that was impairing his functional mobility pre-surgery. I gained knowledge and new techniques by working with this patient that I will take with me as a future physical therapist.

As far as post-operative rehabilitation, I think the management of this patient went very well. The patient had gained all of his PLOF and did not have any more concerns of his right lower extremity. His functional mobility deficits at discharge were solely due to his condition of normal pressure hydrocephalus, and the patient opted to be done with physical therapy once meeting the Medicare cap. However, I learned useful tools for when working with patients with brain disorders to get successful outcomes. Things like a closed environment, along with visual and tactile cues were really beneficial for keeping the patient's attention, concentration, and overall performance of activities.

Overall, this case report provided me with the ability to get an in-depth look at the physical therapy management of a patient. It allowed for extensive research and use of evidence based practice to back-up all aspects of patient care. It also provided the ability to critically analyze how the patient presented every session and decisions for changes made to plan of care.

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