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Inpatient Physical Therapy for a Patient that Underwent Chemotherapy Treatment of Stage II Colorectal Cancer

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INPATIENT PHYSICAL THERAPY FOR A PATIENT THAT UNDERWENT CHEMOTHERAPY TREATMENT OF STAGE II COLORECTAL CANCER

by

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This Scholarly Project, submitted by Ellie Hagen 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.

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Signature Ellie Hagen

Date 10/21/20

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ABSTRACT

Background and purpose. Colorectal cancer, a combination of colon and rectal cancer, is the third most common cancer amongst men and women in the United States. The American Cancer Society estimates 1/22 men and 1/24 women will develop colorectal cancer during their lifetime. Successful treatments are crucial to prolong the lives of these patients and also increase their quality of life during and after chemotherapy. The purpose of this article is to describe the interventions used for a patient with significant debilitation post-chemotherapy for stage II colorectal cancer and the effectiveness of treatment. **Description.** This case study describes the 4-and-a-half-week episode of inpatient physical therapy (PT) of a 73-year-old male with bilateral upper and lower extremity weakness and impaired endurance and balance post-chemotherapy. PT treatment involved lower extremity strengthening, ambulation, stair, transfer, and balance training. Occupational therapy worked on increasing the patient's upper extremity strength and treating the lymphedema. **Outcomes.** The patient achieved good to normal strength in his lower extremities and became independent in all functional activities. He was able to ambulate with a front wheeled walker for a significant distance without fatigue, allowing him to return home. **Discussion.** Treatment rationale was based on journal and textbook information on treatment of cancer patients with lower extremity weakness and lack of endurance. Treatment was altered or progressed based on patient's response.

CHAPTER I

BACKGROUND AND PURPOSE

Colorectal cancer, a combination of colon cancer and rectal cancer, is the third most common cancer amongst both men and women in the United States.[1] It is a cancer that starts in the lower portion of the human digestive system, the rectum or colon.[1] In 2020 alone, it is estimated that there will be 104,610 new cases of colon cancer and 43,340 new cases of rectal cancer.[1] With this cancer affecting a significant amount of the population, successful treatment strategies are crucial to not only prolong the lives of these patients but also to increase their overall quality of life.

The American Cancer Society estimates 1 in 22 men and 1 in 24 women will develop colorectal cancer during their lifetime.[2] With such a high prevalence, it is important to be aware of risk factors that may increase an individual's chance of developing this cancer. Some modifiable risk factors include being overweight or obese, physical inactivity, diets high in red meat, smoking, and heavy alcohol use. Non-modifiable risk factors include being at an older age, a personal and/or family history of colorectal polyps or colon cancer, a history of inflammatory bowel disease, having an inherited syndrome such as Lynch Syndrome, familial adenomatous polyposis, being African American or Jewish from Eastern European descent, and having type II diabetes.[2]

As discussed above, colorectal cancer is a multifactorial disease process, with an etiology encompassing genetic factors, environmental factors such as diet, and inflammatory conditions of the digestive tract.[3] Much about colorectal cancer genetics remains unknown, current research indicates that genetic factors have the greatest correlation to colorectal cancer. Hereditary mutation of the *APC* gene is the cause of familial adenomatous polyposis, in which those affected by this carry a 100% of developing colon cancer by age 40. Dietary factors are also a subject of research related to colorectal cancer.[3] A cohort study by Tabung et al[3] that followed 121,050 men and women for 26 years found that intake of proinflammatory food (diets high in red meat for example), was associated with a significantly higher risk in developing colon cancer. Inflammatory bowel diseases such as ulcerative colitis and Crohn disease also increases the risk in developing colorectal adenocarcinoma. The risk increases with the duration of the inflammatory bowel disease and the greater extent of colon involvement.[3]

There are several stages of colorectal cancer. The stages range from 0 to IV, with the lowest stages indicating the cancer is limited to the lining of the inside of the colon. By stage IV, the cancer has metastasized to other areas of the body.[4] The focus of this case study will be to examine a 73-year-old patient that received physical therapy treatments post-chemotherapy for stage II colorectal cancer. According to the American Cancer Society, individuals with stage II or regional colorectal cancer have a 5-year survival rate of 71%.[4] Survival rates are grouped based on how far the cancer has spread, but a person's age, overall health, and how well the cancer responds to treatment will also affect the prognosis. When looking at colorectal cancer, the progression of it is dependent on the classification of cancer and the treatment.[4] Stage II

colorectal cancer is divided into IIA, IIB, and IIC with stage IIA being least severe to IIC being the most severe.[4] Stage II cancers are often treated with surgery to remove the affected areas, however chemotherapy is recommended for more advanced stages, such as IIC, where the surgeon is not able to remove all of the cancer cells.[4]

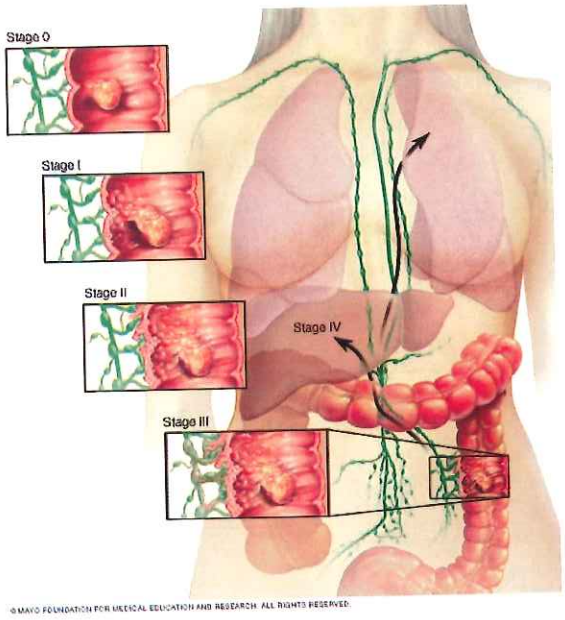

Figure 1. Stages of colon cancer[5]

Some common clinical presentations of colorectal cancer include iron-deficiency anemia, rectal bleeding, abdominal pain, change in bowel habits, and intestinal obstruction or perforation. In the early stages of the disease, physical findings may include fatigue, weight loss, or nothing at all.[3] In the more advanced stages, findings may include abdominal tenderness, rectal bleeding, palpable abdominal mass, hepatomegaly, and ascites.[3] These findings may lead to physicians to do lab studies, imaging studies, or other procedures in order to make a diagnosis. Laboratory studies include complete blood count, liver function tests, and

serum carcinoembryonic antigen. Imaging that may be done include chest radiography, chest, abdominal, and/or pelvic CT, as well as an abdominal/pelvic MRI. Lastly, other procedures that may be warranted include a colonoscopy or sigmoidoscopy.[3]

Surgery and chemotherapy are the most common treatments for patients with colorectal cancer. Surgery currently is the most definitive treatment option.[3] Figure 2 illustrates standard colectomies for adenocarcinoma of the colon.[3] Chemotherapy is used when the cancer has reached more advanced stages. It is used to kill cancer cells and also control the growth of tumors. Chemotherapy is an aggressive form of chemical drug therapy that is meant to destroy rapidly growing cells in the body, especially cancer cells which grow and divide faster than other cells.[3] Chemotherapy is considered a systemic treatment, meaning it affects the entire body. Since cancer cells are not the only rapidly growing cells in the human body, this treatment may also adversely affect a person's blood, hair, skin, and intestinal tract lining.[3] Because of this, the side effects of chemotherapy may include susceptibility for bruising and excessive bleeding, diarrhea, dry mouth, mouth sores, fatigue, muscle weakness, joint stiffness, loss of endurance, loss of bone density, loss of balance, heart problems, fever, hair loss, loss of appetite, nausea, vomiting, weight loss, pain from nerve damage, infections, anemia, constipation, neuropathy, lymphedema, insomnia, sexual changes and skin changes.[3] Due to this, chemotherapy has been proven to effectively attack cancer cells, it can also cause serious side effects that severely impact a patient's quality of life.

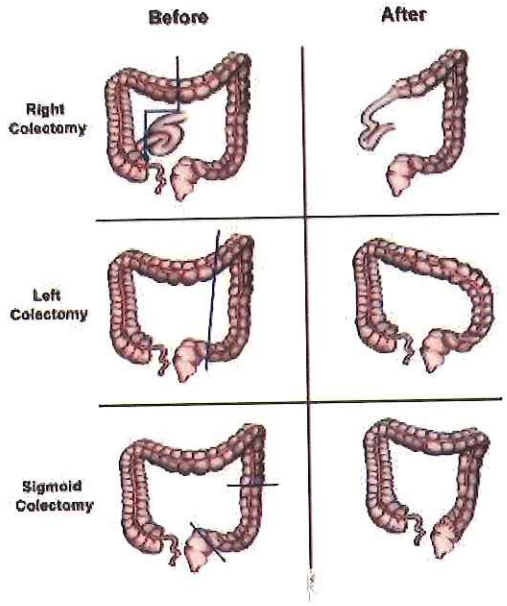

Figure 2: Colectomies for colon cancer [3]

Due to the adverse side effects that come from chemotherapy treatment, individuals with cancer often undergo physical rehabilitation during or after treatment in order to maintain or improve their quality of life. Physical rehabilitation has been shown to have a positive impact in these patients' overall quality of life. However, there have been no studies done that address specifically what the most effective exercise prescription is for these patients. The aim of this study is to investigate what an effective course of physical therapy is for a patient with stage II colorectal cancer that has significant physical debilitation post-chemotherapy treatment.

Prognostic studies have been done to determine the short- and long-term effects of physical activity during cancer treatment, such as chemotherapy. According to a meta-analysis performed by Witlox et al,[5] patients with breast or colon cancer who participated in an 18-week exercise intervention showed significantly higher levels of moderate to vigorous total physical

activity levels and a tendency toward lower physical fatigue levels at 4 years post-baseline.[5] When looking at the short-term effects, a study in 2006 described the impact of a 6-week multidimensional exercise intervention focusing on one-repetition maximum, maximum oxygen uptake, activity level, general well-being and quality of life in cancer patients undergoing chemotherapy.[6] The results demonstrated a highly significant increase in muscular strength ($p<0.001$), physical fitness ($p<0.001$), and physical activity levels ($p<0.001$). There was also a significant reduction in reports of fatigue ($p=0.006$) and pain ($p=0.03$).[6] Patients with advanced disease were able to improve their results as well, indicating significant clinical meaning for cancer patients.[6]

Another meta-analysis conducted by Nakano et al.[7] specifically looked at the effects of aerobic and resistance training in cancer patients. The meta-analysis compared 10 different studies that all used different forms of aerobic and resistance exercise for treatment of cancer patients either currently undergoing or who had just completed chemotherapy.[7] The cancer types were all mixed, the duration of the exercise programs ranged from three weeks to sixteen weeks, and the participants gender and age had a wide range.[7] The main conclusion of the study found that exercise intervention was confirmed to improve fatigue, pain, insomnia, and dyspnea in these cancer patients.[7] The researchers also concluded that further research is warranted to examine the effects of exercise interventions on physical symptoms in cancer patients.[7]

One relevant systematic review conducted in 2017 aimed to investigate the current evidence for aerobic and resistance training during treatment of colorectal cancer patients.[8]

The purpose was to improve functional capacity and diminish postoperative complications.[8] Based on the systematic review, a supervised combined endurance/interval training appears to be effective at improving functional capacity (VO2 peak) and lower extremity muscle strength.[8] They concluded that strength training that focuses on lower extremity appears to be very important for the enhancement of both strength and endurance capacity, and should consist of the leg press, knee extension/flexion, and exercises that target the gluteal and thigh region.[8] The largest VO2 peak was reported in a 12 week, 3 days per week supervised, high intensity regimen.[8]

The studies discussed all demonstrate high efficacy as they report positive effects on physical symptoms in cancer patients. However, more research is needed to determine what the most effective course of treatment is. This case study will look at determining an effective form of resistance and aerobic exercise specifically for a patient with stage II colorectal cancer that has undergone chemotherapy. His primary physical therapy diagnosis is bilateral upper and lower extremity weakness. Screening criteria used to accept this patient for physical therapy looked at his medical history and current comorbidities. The patient had no comorbidities or medical history that would deem him unsafe to participate in physical therapy.

There is currently no theoretical framework for physical therapy treatments in patients with physical debilitation during or post-chemotherapy treatment. With the high prevalence of colorectal cancer amongst both men and women, it is critical that physical therapists are able to provide these patients with the most effective treatment to allow them to regain the highest quality of life possible.

Key words: colorectal cancer, chemotherapy, lymphedema, peripheral neuropathy, regional colorectal cancer

Definitions:

Colorectal cancer: a cancer of the colon or rectum, located at the digestive tracts lower end.

Chemotherapy: a type of cancer treatment that uses one or more anti-cancer drugs as part of a standardized chemotherapy regimen.

Lymphedema: swelling in an arm or leg caused by lymphatic system blockage.

Peripheral neuropathy: weakness, numbness, and pain from nerve damage, usually in the hands and feet.

Regional colorectal cancer: The cancer has spread outside the colon or rectum to nearby structures or lymph nodes.

Familial adenomatous polyposis: An inherited disorder characterized by cancer of the large intestine and rectum.

Lynch Syndrome: A type of inherited cancer syndrome associated with genetic predisposition to certain types of cancer.

Stage IIA: Cancer has spread to the serosa, or outer colon wall, but not beyond that.

Stage IIB: Cancer has spread beyond the serosa but has not affected nearby organs.

Stage IIC: Cancer has affected the serosa and the nearby organs.

CHAPTER II

CASE DESCRIPTION

The patient is a 73-year-old caucasian male that was diagnosed with stage II colorectal cancer in 2018. He began chemotherapy treatment immediately following diagnosis and continued to have treatment until August 29th of 2019, which is when he was admitted to a swing bed program due to severe debilitation. The patient's chief complaint is full body weakness due to the effects of chemotherapy. His chemotherapy was put on hold, however, the cancer was being managed. Prior to chemotherapy treatment, the patient was independent in all functional activities. In regard to his functional status at the time of admittance to the swing bed, he required moderate-maximum assistance of 1 for all transfers. He was able to roll from supine to side lying with use of the bed rail, although it required maximal effort from the patient. He required a dependent transfer and a front wheeled walker in order to allow him to walk.

Prior to his admission to the swing bed, the patient had been hospitalized due to pancytopenia, odynophagia, anemia requiring transfusion, thrombocytopenia, adrenal insufficiency, and malnutrition secondary to a caloric deficit which resulted in significant bilateral lower extremity lymphedema. He received some physical therapy treatment during this hospital stay consisting of bed mobility and upper extremity resistance exercises, however, his primary treatment for his weakness was in the swing bed. He has a past medical history of hyperlipidemia and hypertension which are both being managed with medications. In regard to

his psychological history, he had a previous diagnosis of depression and was not taking any medications for that. The patient had no history of smoking, drug or alcohol use, and lived a sedentary lifestyle prior to being admitted to the swing bed.

The medications that this patient was taking at the time of physical therapy treatment included chlorthalidone to treat his hypertension and simvastatin to treat his hyperlipidemia. The side effects of chlorthalidone that may affect his ability to participate in physical therapy include dizziness, lightheadedness, drowsiness, fatigue, and nauseas. The pertinent side effects of simvastatin include nausea, stomach pain, muscle pain or weakness and joint pain.

A brief history was taken prior to beginning the examination. The patient was retired and lived with his wife on a farm. He enjoyed fishing and spending leisurely time with his grandchildren. His wife was his primary care giver and took on the role of transporting the patient to and from doctor appointments. He was using a wheelchair prior to his admission to the swing bed. The patient and wife's goal was for him to gain enough strength to be independent in all functional mobility in order for him to return home safely.

Throughout the history and into the examination, a brief systems review was conducted. There were no direct complications to the integumentary system. The patient reported that he was experiencing no pain. When asked orientation questions of person, place, and time he was able to answer all correctly (orientated x 3). The patient demonstrated weakness in ankle dorsiflexion and plantarflexion, indicating potential for peripheral neuropathy and an impaired nervous system. However, he reported no numbness or weakness when assessing dermatomes. He had significant bilateral lower extremity lymphedema, demonstrating an impaired lymphatic

system. This is common in cancer patients that have undergone chemotherapy. When looking at the cardiopulmonary system, his heart rate was at 76 bpm and his blood pressure was at 126/88 mmHg, however he experienced fatigue upon standing which demonstrates potential functional limitations. His musculoskeletal system demonstrated direct impairment with his full body weakness.

The clinical impression of this patient was that chemotherapy had taken a toll on his body, and he was in critical need of physical therapy as well as other disciplines to help increase his strength and functional mobility. The patient was independent in all functional activities prior to starting cancer treatment, which shows potential to return to that. Based on the patient's history and review of systems, it was decided to move forward with the full examination in order to determine an appropriate intervention plan for him.

Examination, Evaluation and Diagnosis

Upon the initial examination, tests and measurements were taken in order to determine the patient's functional status. Range of motion (ROM) was measured with the patient lying supine in bed. This was done in order to assess the patients joint and tissue mobility. The technique used to assess his ROM was based off of Kisner and Colby's published book titled "Therapeutic Exercise-Foundations and Techniqes."[9] Active range of motion (AROM) and passive range of motion (PROM) of his lower extremities were measured. The patient was limited due to weakness which made it difficult for him to hold up his leg. This limitation may have reduced the reliability of the measurements, which are listed in the table below.

Table 1: initial AROM and PROM measurements of the patient's lower extremities

Hip flexion supine	AROM/PROM L: 15/115 degrees R: 20/115 degrees
Knee extension supine	AROM L: 0 degrees R: 0 degrees
Knee flexion supine	AROM/PROM L: 30/135 degrees R: 30/135 degrees

The patient then was assisted into his chair using an overhead lift. Manual muscle testing of the patient's lower extremities was performed with the patient seated in his chair. This was done in order to get a gross screening of the patient's lower extremity strength. The technique used to perform manual muscle testing was based off of Lynn Van Ost's booked titled, "Cram Session in Goniometry and Manual Muscle Testing, a Handbook for Student's and Clinicians."[10] The initial results are listed below.

Table 2: Initial manual muscle testing results of the patient's lower extremities

Hip flexion seated	3/5
Hip abduction seated	4/5
Hip adduction seated	4/5
Knee extension seated	3/5
Knee flexion seated	3/5
Ankle dorsiflexion seated	4/5
Ankle plantarflexion seated	4/5

The patient's lower extremity sensation was tested using dermatomes, and they were all within normal limits (WNL). The overhead lift was then used to see how far the patient could ambulate with a front wheeled walker (FWW), and he was able to go 10 feet in his room before fatigue set in and he needed to sit down. The patient also demonstrated impaired balance

while ambulating. Overall, the patient's independent activity and participation was restricted to bed mobility. He required moderate – maximum assistance for all other mobility.

There have been numerous studies performed to determine the reliability and validity of goniometry and manual muscle testing. Jules et al.[11] examined the reliability of goniometric measurements taken in a clinical setting, and the results indicated that the measurements are highly reliable. It was found that intratester reliability for knee and elbow flexion and extension was high (r= .91 - .99), and intertester reliability was also high (r= .88 - .97).[11] As discussed previously, the patient was limited in his mobility due to weakness, so this may be a limitation in getting the most reliable AROM measurements. One review in 2007[12] looked at the reliability and validity of manual muscle testing in the clinic. When looking at reliability, the results ranged from 82%-97% agreement for intertester reliability and 96%-98% for test-retest reliability.[12] There was significant improvement in the degree of consistency when examiner had more clinical experience and manual muscle test training.[12] The validity of manual muscle testing was also examined in this review by looking at the results compared to dynamometers. The scores measured with dynamometers were consistent with the examiner's perception of muscle weakness in both studies ($p<.001$).[12] In regard to specificity and sensitivity, one study by Bohannon[13] looked at 107 rehabilitation patients in which manual muscle testing was performed on. The results found that specificity was mostly >80%, however sensitivity never exceeded >75%.[13] These results cast some doubt as to the suitability of manual muscle testing as a screening test for muscle impairments. In the case of this patient where a dynamometer was not available, manual muscle testing was used as a simple tool to assess baseline strength.

The initial examination shed light on the patient's primary limitations and functional status. His lower extremity muscle weakness and impaired endurance were the main causes of the patients impaired functional status. His limited AROM was not due to impaired joint or tissue mobility but instead was a direct result of his muscle weakness, as demonstrated by his normal PROM. His impaired balance also seemed to be a direct result of the patient's lower extremity weakness. The patient's bilateral lower extremity lymphedema was also a contributing factor to his weakness, due to the increased weight of his lower extremities. Due to this weakness, he was unable to transfer without moderate – maximum assist of 1 and required the Hoyer lift to ambulate. He was only able to ambulate for 10 feet due to impaired endurance and fatigue. The patient's problem list is listed in the table below.

Table 3: Patient's problem list

Problem list:
1. Stage II colorectal cancer 2. Impaired bilateral lower extremity strength 3. Impaired endurance 4. Impaired balance 5. Bilateral lower extremity lymphedema

Using the Guide to Physical Therapist Practice, he was placed in practice pattern 6B: Impaired Aerobic Capacity/Endurance Associated with Deconditioning.[14] The ICD-10 code is R53.1 for his lower extremity weakness, R53.83 for decreased endurance, and R26.89 for decrease balance.[15]

Prognosis and Plan of Care

The patient was seen 6 days a week for 30-45 minutes a day over a four-and-a-half-week period. The physical therapy interventions included lower extremity strengthening, endurance training, transfer training, ambulation and stair training, and balance exercises. Occupational therapy also worked with this patient 6 days a week, focusing on increasing his upper extremity strength and decreasing his lymphedema in his legs. For his stay in the swing bed, the patient's first short term goal was to be able to transfer with contact guard assist (CGA) of 1 in order to increase his independence to allow him to return home safely. His second goal was to ambulate 25 feet in order to increase his endurance to allow him to ambulate safely at home. His third short term goal was to complete 10 repetitions of seated exercises in order to increase his lower extremity strength to allow him to perform activities of daily living (ADLs) with less difficulty. These are to be completed in 2 weeks following physical therapy intervention. The patient's long-term goal was to be able to perform all functional activities/ADLs independently in order to increase his safety to allow him to return home. This goal was to be completed in 4 weeks following physical therapy intervention. Considering the patient's functional status at the initial evaluation, reaching his short- and long-term goals was thought to be a challenge, especially due to the unknowns of his colorectal cancer. However, the patient was very

motivated to return home and was ready to work hard to get there. He had the potential to reach his goals in 4 weeks based on the frequency of physical therapy treatment (6 days per week), the halting of chemotherapy, and his determination/motivation.

Based on the patient's examination findings, the initial clinical impression was confirmed, deeming the patient appropriate to participate in and receive physical therapy interventions. As the patient progressed in physical therapy, evaluation of his strength and ROM was assessed every other week using functional measures.

CHAPTER III

INTERVENTION

Week 1: The first week of physical therapy treatment was focused on improving the patient's bed mobility and leg strength. Therapy worked on the patient's bed mobility for rolling and repositioning. For rolling, his legs were assisted into hook lying position, and then he was educated how to roll onto his side by using the bed rail to pull himself over. Occupational therapy worked with him every day on upper extremity strengthening, which allowed him to gain enough strength to be able to successfully roll over and reposition himself in bed. For the first three days, he began walking with the mechanical overhead lift in order to put some weight through his lower extremities. He would ambulate around his room for 3-5 minutes. Towards the end of the week, he progressed to standing with a front wheeled walker with moderate assistance of 2 without the mechanical lift. In order to increase his leg strength, the patient performed daily exercises in bed consisting of ankle pumps, quad sets, hamstring sets, gluteal sets, heel slides, short arc quads, straight leg raises, hip abduction and adduction slides, and bridging. Therapy began with a goal of 1 set of 10 reps and slowly progressed to 2 sets as he gained strength. Once he was able to stand in the FWW, weight shifting in the parallel bars was added. At the end of the week, the patient was able to come to stand using moderate assist with his knees blocked and the bed raised to a higher level. The patient was also able to use his arms to assist in scooting himself up in bed with the head of the bed raised, however he still needed someone to assist his legs into hook lying. He was also able to stand in the parallel

bars for 45 seconds with weight shifting and was able to do mini marches with light upper extremity support without a loss of balance or knees buckling.

Figure 3: Overhead lift used for initial patient ambulation[17]

Week 2: The second week was focused on increasing the patient's functional mobility with sit to stands and transfer training. Therapy also continued to work on increasing his lower extremity strength and aerobic capacity. Each day would begin by working on sit to stands, which were a challenge for him because his quadriceps were significantly weak. He would start with a set of 3 repetitions with rest breaks as needed. Therapy would then work on ambulation by having him use his FWW to walk to the therapy room, increasing his distance as tolerated. He would go on the NuStep for 10 minutes, starting at a low resistance and working up to a higher resistance throughout the week. This allowed him to work on his aerobic capacity, as well as increase his

upper and lower extremity strength without putting full weight through them. He tolerated this well and by the end of the week he was able to lift both of his legs into the pedals on his own. Each session would end by having him do seated leg exercises consisting of leg extensions, hamstring curls, hip adduction and abduction, and hip flexion. A level 1 TheraBand was used with these exercises to increase resistance, and the goal was to do 2 sets of 10 repetitions of each. By the end of the week, the patient was able to ambulate while using the FWW for 175 feet with no rest break. He also was able to transfer sit to stand with min/mod assistance with no knee block, which was a big improvement from the previous week.

Figure 4: NuStep utilized during physical therapy[18]

Week 3: The third week of treatment consisted of continued work on strengthening the patient's lower extremities, improving his functional mobility, improving his balance, and improving stair climbing. Each session began by having him ambulate down to the therapy

room with his FWW to work on increasing his endurance and functional mobility. Interventions included standing exercises in the parallel bars consisting of mini marches, hamstring curls, leg extensions, hip abduction, and heel raises. He was able to do 2 sets of 10 repetitions of each. Balance in the parallel bars was included by having him stand on a foam pad with feet parallel, in front of each other, eyes closed and then single leg stance.[19] On days that he did not do the NuStep, he would work on stair training on 4-inch stairs with his FWW and a therapist assisting. By the end of the week, the patient was able to ambulate 120 feet x 2 with a FWW and CGA of 1. He was able to step up and down three 4-inch steps slow but steady and increase his resistance on the NuStep. He also only required CGA for his sit to stands, showing a huge improvement in his lower extremity strength.

Week 4: The fourth week of treatment consisted of preparing the patient to be discharged next week and making sure he was completely independent in functional mobility. During the course of the week, the patient was able to step up and down eight 6-inch steps in order to be able to get into and out of his house. The patient was able to increase his ambulation distance to 150 feet x 2 while using a FWW with CGA. He was able to transfer sit to stand independently and complete bed mobility with no issues. The plan was for him to be discharged the middle of the next week.

Week 5: The patient was seen 3 times this week and therapy worked on continued lower extremity strengthening using the standing exercises discussed previously. The patient was sent home with a home exercise program consisting of standing marches, hip abduction,

hip extension, hamstring curls, and toe raises. He was instructed to complete 2 times a day doing 15 repetitions of each exercise. The patient was discharged on 10/02/19.

The rationale for the use of the selected interventions was based off of studies that indicate the positive effects of strength and endurance training in cancer patients that have undergone chemotherapy. According to Nakano et al,[7] aerobic and resistance training has shown to relieve cancer related physical symptoms such as fatigue, pain, and insomnia. This meta-analysis also showed that dyspnea improved significantly in cancer patients after undergoing resistance and aerobic training.[7] Many of the successful interventions included aerobic exercise using a dual action ergometer, for example, a NuStep. The resistance training consisted to 2-3 sets of 10 repetitions using 6-7 different lower extremity exercises. These were performed 3-5 days per week for 30 minutes a day.[7] A systematic review from 2018 looking at the effects of exercise training in colorectal patients found that endurance training alone was found to increase both lower extremity strength and endurance capacity.[8] This patient was appropriate for this intervention plan, because based on the research he has a very high chance of greatly improving his quality of life. It is indicated that he participates in physical therapy, because increasing his strength and endurance is the only way for him to regain his functional mobility and return home to his wife. There were no interventions physical therapy deemed necessary that were excluded from this patient's plan of care.

Patient and the family-related instruction was also an important part of the patient's physical therapy sessions. During the course of his treatment, the patient was instructed on how to properly perform his exercises and how to know when he is overworking himself. He

was a very motivated patient that was determined to go home and sometimes would push himself too hard and push himself to points of extreme fatigue. He was educated on the importance of working hard but also on giving his body time to rest and recuperate. He was also educated on ambulating and going up and down the stairs safely with a FWW. During the last week of his treatment session, he and his wife were instructed on his home exercise program as well as how to transfer him in and out of a car safely.

During the course of the patient's treatment sessions, many other disciplines were involved which include nursing, occupational therapy, a dietician, and physicians. Each day before his session began, physical therapy would communicate with the nursing staff and touch base on the patient's status, making accommodations as needed. Occupational therapy worked with this patient in order to increase his upper extremity strength and decrease his lower extremity lymphedema using lymphedema wraps.[20] Physical therapy would communicate with occupational therapy based on the patient's progress throughout the course of his stay in the swing bed. Patient care conferences were also held weekly which consisted of all of the disciplines discussed previously as well as the patient and his wife. These were done to get everyone on the same page, educate the patient and his wife, and come up with the best plan of care for him.

CHAPTER IV

OUTCOMES

After the patient's 4 and a half weeks of physical therapy, his outcomes are listed below.

Table 4. Patient's AROM/PROM at discharge.

Hip flexion supine	AROM/PROM L: 95/115 degrees R: 90/115 degrees
Knee extension supine	AROM L: 0 degrees R: 0 degrees
Knee flexion supine	AROM/PROM L: 100/135 degrees R: 100/135 degrees

Table 5. Patient's manual muscle testing at discharge.

Hip flexion seated	4+/5
Hip abduction seated	5/5
Hip adduction seated	5/5
Knee extension seated	4+/5
Knee flexion seated	4+/5
Ankle dorsiflexion seated	5/5
Ankle plantarflexion seated	5/5

When the patient first came to therapy, he was very weak due to the chemotherapy treatments he had been receiving. After they put chemotherapy on hold, physical therapy worked with him every day to get him to his status at the time of discharge, and he was very motivated to be independent again. The patient increased his hip flexion, knee flexion and extension strength from a 3/5 to a 4+/5 and his hip abduction, hip adduction, plantar flexion, and dorsiflexion strength from a 4/5 to a 5/5 bilaterally. He went from a total assist with sit to

stands to independent and at discharge was able to ambulate 150 feet or more with a FWW. At discharge, the patient did not have any functional limitations and had achieved all of his therapy goals.

In regard to a clinometric scale, one that could be used with this patient is the Functional Assessment of Cancer Therapy: General, also known as the FACT-G. This scale assesses a patient's physical well-being, social/family well-being, emotional well-being, and functional well-being. The questions are easy to understand, and studies have been done that show it to be a valid and reliable scale for cancer patients.[16]

This became a challenging case towards the end of the patient's stay in swing bed for a few reasons. During the fourth week the patient was seen by his physician to discuss further chemotherapy treatment for his cancer. The physician discussed a new form of chemotherapy that was not as harsh on the body. He informed the patient that if he refrained from chemotherapy, he would only have weeks to live. The physician went on to tell the patient that if he decided to move forward with chemotherapy, he would have only 1 year left to live. Knowing how weak the chemotherapy had made him previously, the patient chose not to have additional chemotherapy treatment. It was a very difficult decision to make after all the progress that had been made in therapy. This decision not only effected the patient's mood every day, but it also decreased his motivation to participate in further therapy. He was compliant; however, he did not want to do as much and became a little more resistant, understandably. Although this news was devastating, the patient expressed much gratitude towards the interdisciplinary staff that worked with him to allow him to regain independence.

Without physical therapy the patient would not have been able to regain his functional mobility, and for that reason, he seemed very satisfied with his results.

CHAPTER V

DISCUSSION

Throughout the course of this patient's physical therapy treatment he made significant progress and achieved excellent results at the end of the 4 weeks. The results are due to the interventions discussed previously as well as the patient's motivation and hard work each and every day of therapy. The resistance exercises and transfer training allowed the patient to gain enough lower extremity strength to be independent in functional activities such as ambulating, going up and down the stairs, and performing ADLs. The aerobic interventions allowed the patient to improve his endurance to be able to ambulate safely in his home. These findings confirm that resistance and aerobic exercises can help a patient recovering the detrimental effects of chemotherapy return to being independent.

The examination/measurement procedures such as MMT, ROM, and ambulation were crucial in determining the patient's limitations and also helped to guide the future interventions. MMT was used to obtain a gross baseline measurement of his strength and determine what muscles were limiting his functional mobility the most. The functional ROM measurements helped determine that he was limited due to weakness instead of a joint or tissue restriction. And lastly, ambulating with a FWW allowed physical therapy to determine his level of endurance. These measurements helped to guide the interventions because they helped determine his primary limitations that needed to be focused on first.

In relation to other studies, the results of this case study demonstrate similar results and supports the original hypotheses that physical therapy can help increase this patient's functional mobility. As discussed previously, a study in 2006[6] described the impact of a 6-week multidimensional exercise intervention in cancer patients undergoing chemotherapy.[6] The exercise interventions focused on resistance and aerobic exercise. The results demonstrated a highly significant increase in muscular strength ($p<0.001$), physical fitness ($p<0.001$), and physical activity levels ($p<0.001$). There was also a significant reduction in reports of fatigue ($p=0.006$) and pain ($p=0.03$).[6]

Similarly, a meta-analysis conducted by Nakano et al.[7] looked at the effects of aerobic and resistance training in cancer patients. The main conclusion of the study found that exercise intervention was confirmed to improve fatigue, pain, insomnia, and dyspnea in these cancer patients.[7]

Lastly, a systematic review conducted in 2017 that aimed to investigate the current evidence for aerobic and resistance training during treatment of colorectal cancer patients concluded that strength training that focuses on the lower extremities appears to be very important for the enhancement of both strength and endurance capacity. These exercises should consist of the leg press, knee extension/flexion, and exercises that target the gluteal and thigh region.[8]

These findings indicate that there is strong evidence to support significant results with resistance and aerobic training in cancer patients. Chemotherapy can have detrimental effects on cancer patients, and these results show that physical therapy intervention consisting of

primarily aerobic and resistance training can help these patients greatly improve their functional mobility to increase their quality of life.

In the future, there should be meta-analyses done on specific types of resistance and aerobic exercises, comparing different frequencies, intensities, and time (FITT principles) of the exercises for cancer patients undergoing chemotherapy. As of right now there is a general agreement that aerobic and resistance exercise can improve these patient's functional mobility and quality of life, however there are no studies that look at which specific FITT principles generate the best results.

This case study has a few potential limitations. One limitation is that there is no way of determining what the patient's long-term prognosis is due to the recurrence of his cancer. Another potential limitation is the minimal exercise equipment available for this patient to use. Several studies suggested that the leg press and other weight machines significantly improved lower extremity strength in cancer patients and these resources were unavailable for this patient. Lastly, the minimal research on patients with stage II colorectal cancer done prior to accepting this patient for care was a limitation to this case study. It would have been beneficial to have more evidence specific to stage II colorectal cancer in order to back up the plan of care.

Reflective Practice

When reflecting back on this case, there are certainly a few things that would be done differently next time if ever working with an identical patient. In regard to the history taking, asking about the patient's previous cancer treatments and how those affected him would be important information to obtain. This patient had colon cancer previous to this new diagnosis and underwent chemotherapy treatment for that, so in the future it would be important to ask

how his functional mobility was affected previously. For the examination procedure, there is nothing that would be changed because everything was done that the patient was able to do. Baseline strength and mobility was assessed in the most efficient way available and it provided physical therapy with a good starting point and goals to work toward.

For the plan of care, one thing would be done differently is adding more education to both the patient and his wife on his cancer diagnosis and what to expect moving forward. Education was provided to the patient on the importance of exercising in order to maintain his functional mobility, but what to do if the cancer progresses and he starts to lose his independence again was not discussed. The other change that would be made is focusing more on lower extremity strengthening. There was a large focus on endurance training as well as resistance, however, research indicates that lower extremity strengthening has been shown to increase these patient's aerobic capacity as well as strength.[7]

One area in this case report where further evidence is needed is for the prognosis of stage II colorectal cancer patients. The prognostic article found was based on patients with primarily breast cancer at various stages. Although the results were promising, it would be beneficial to find evidence on the prognosis of patients with specifically stage II colorectal cancer in order to rule out any other factors that could significantly impact a patient's outcome.

If evaluating an identical patient to the one in this case study sometime in the future, physical therapy would still be necessary along with the assistance of other disciplines. Based on the outcomes of the patient in this case study, it is fair to say that physical therapy had a significant impact on this patient's functional ability and overall quality of life. Without physical

therapy he would not have been able to regain the strength in order to become independent again and return home. In the future, it would still be critical to work closely with occupational therapy, nursing, a dietician, and the physician due to the patient's cancer and other comorbidities. An interdisciplinary team is crucial for this patient to receive all the necessary treatment.

APPENDIX

FACT-G: full version can be found using the hyperlink below:

https://academic.oup.com/jjco/article/34/7/393/815680

FACT-G (Version 4)

Below is a list of statements that other people with your illness have said are important. **Please circle or mark one number per line to indicate your response as it applies to the past 7 days.**

	PHYSICAL WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GP1	I have a lack of energy	0	1	2	3	4
GP2	I have nausea	0	1	2	3	4
GP3	Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
GP4	I have pain	0	1	2	3	4
GP5	I am bothered by side effects of treatment	0	1	2	3	4
GP6	I feel ill	0	1	2	3	4
GP7	I am forced to spend time in bed	0	1	2	3	4

	SOCIAL/FAMILY WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GS1	I feel close to my friends	0	1	2	3	4
GS2	I get emotional support from my family	0	1	2	3	4
GS3	I get support from my friends	0	1	2	3	4
GS4	My family has accepted my illness	0	1	2	3	4
GS5	I am satisfied with family communication about my illness	0	1	2	3	4
GS6	I feel close to my partner (or the person who is my main support)	0	1	2	3	4
Q1	*Regardless of your current level of sexual activity, please answer the following question. If you prefer not to answer it, please mark this box* ☐ *and go to the next section.*					
GS7	I am satisfied with my sex life	0	1	2	3	4

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