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A Case Report: Paraplegia Secondary to a Failed Lumbar Fusion

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A Case Report: Paraplegia Secondary to a Failed Lumbar Fusion

by

Nicole Jefferson

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine and Health Sciences

University of North Dakota

in partial fulfillment of the requirements for the degree of

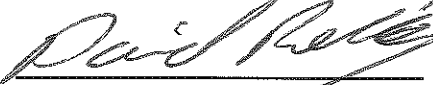
Doctor of Physical Therapy

Grand Forks, North Dakota

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This Scholarly Project, submitted by Nicole Jefferson 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)


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A handwritten signature in black ink, appearing to read "Michelle J. [unclear]", written over a horizontal line.

Date

9/4/15

TABLE OF CONTENTS

LIST OF FIGURES	v
ABSTRACT	vi
CHAPTER	
I. BACKGROUND AND PURPOSE.....	1
II. CASE DESCRIPTION.....	4
Examination, Evaluation and Diagnosis	6
Prognosis and Plan of Care.....	9
III. Intervention.....	11
IV. Outcomes.....	14
V. Re-Evaluation	15
Examination, Evaluation and Diagnosis	15
Prognosis and Plan of Care	17
Intervention	17
Outcomes	18
VIII. DISCUSSION.....	20
Reflective Practice.....	20
REFERENCES	22

LIST OF FIGURES

1. Thoracic disk	2
2. The VAS (visual analogue scale)	7

ABSTRACT

Background and Purpose

Low back pain is one of the most common symptoms that individuals experience around the world. The total cost for low back pain in the United States are over a billion dollars per year. Although an ample amount of research has been done looking into the epidemiology and treatment of back pain, many people are still suffering from lack of effective treatments.

Case Description

The purpose of this case report was to describe a patient who was post lumbar surgery to evaluate and examine the benefits of physical therapy. The patient in this case report was a 56-year-old male who was undergoing his second spinal surgery secondary to degenerative disk disease.

Intervention

The patient was treated by physical therapy with therapeutic activity, exercise, gait training and patient education after his first surgery. Physical therapy provided him with patient education and therapeutic activity after his second surgery. Activity was limited due to severe pain.

Outcomes

The patient slowly progressed and was discharged to a nursing home. Ten days later the patient returned with complications due to instrumentation failure and was sent to the operating room for a second surgery. The patient was diagnosed a paraplegia post-surgery. Shortly after, the patient was transferred to a spinal rehabilitation facility for further specialized care.

Discussion

More resources need to be put into researching how common failed back surgeries are and ways to prevent and treat this issue.

CHAPTER I

BACKGROUND AND PURPOSE

INTRODUCTION

For years, low back pain (LBP) has been known to be one of the most common symptoms known to mankind. “Only the common cold exceeds back pain in terms of the frequency of complaints that are heard by primary care physicians. Socioeconomic factors are important risk factors for lumbar pain and disability. The total costs of low-back pain in the United States exceed \$100 billion per year.”^{1p.1}

The first unequivocal findings of degeneration in the lumbar discs are seen in the age group 11–16 years. About 20% of people in their teens have discs with mild signs of degeneration; degeneration increases steeply with age, particularly in males, so that around 10% of 50-year-old discs and 60% of 70-year-old discs are severely degenerate.^{2p.1}

Because the incidence rates and socioeconomic costs of back disorders are substantial, it is important to find the most effective and beneficial treatments for these individuals with LBP. Although an ample amount of research^{3,4,5} has been done looking into the epidemiology and treatment of back pain, many people are still suffering from lack of effective treatments. After typing in “back pain” in a standard Google search, 183,000,000 sites show up from “Low Back Pain Symptoms, Diagnosis and Treatment”, to “Lebron James vows to play in Game 5 despite

low back pain". These sites provide a generous amount of people's opinions on what interventions worked and did not work for them, case reports^{6,7}, research, as well as, advertisements for back braces and antibiotics.

RESEARCH

The intervertebral disc (IVD) is composed of a central nucleus pulposus (NP) which allows for the absorption of water. The NP is important for bearing axial loads that are put on the IVD. A fibrous structure called the annulus fibrosus (AF) surrounds the gelatinous material

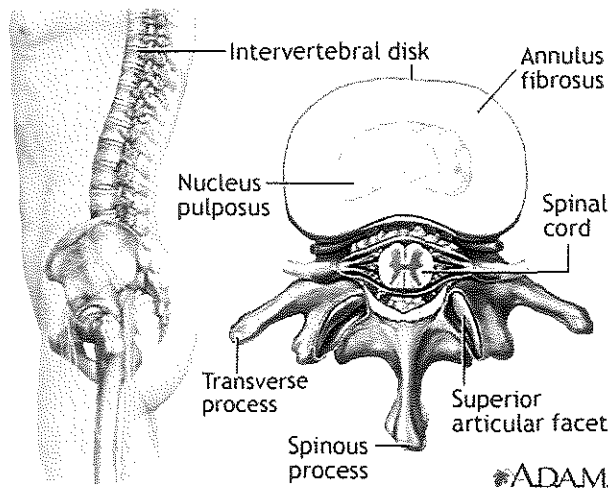


Figure 1. Thoracic disk⁸

in the NP and protects it from herniating or "leaking out". As an individual increases in age, the water content in the NP decreases and fissures and may extend into the AF which causes the beginning processes of degenerative disc disease (DDD).⁸ Genetic and environmental factors play a significant role in DDD. Occupations that require increased

lifting, twisting and whole body vibrations (such as truck drivers) are at an increased risk for accelerated DDD. One study provides evidence that BMI above 25 kg/m² increases the risk of lumbar disc degeneration. Being overweight at young age seems to be particularly detrimental.⁹ Some individuals that have DDD may not have symptoms such as pain, decreased strength and range of motion (ROM), or radiculopathy (compression of a nerve root that can cause numbness, tingling throughout the path of the nerve). However, many individuals with this disease experience these debilitating symptoms. Many studies have been done on treatment strategies for lumbar DDD. "Spinal fusion surgery is a recognized treatment option of LBP but its efficacy

and success remain controversial. While fusion procedures offer a way of eliminating motion between spinal segments, and thus alleviate discogenic pain associated to degenerative changes, they address only a symptom and not the cause of DDD.”^{10p.1} Disc arthroplasty has the purported advantage of removing the degenerated intervertebral disc and replacing it with a prosthesis that will allow motion between the segments. Clinical trials have shown equivalent results compared with circumferential fusion for the treatment of discogenic pain.¹ Many studies are currently being performed looking at stem cells and the ability to alter degenerative genes. Even though there is a significant amount of research that has been done on the treatment of DDD, there is not a conclusive answer to what is the best surgical and treatment approach. “Advances in fields such as genomics, nanotechnology, stem cell biology, gene therapy, and tissue engineering have tremendous therapeutic potential for clinical applications in degenerative disorders such as DDD, but novel treatment strategies for lumbar disc degeneration require further evaluation in preclinical and clinical trials.”^{3p.10}

The patient discussed in this case study was selected due to prevalence of degenerative disc disease and the effect of post-surgical therapy interventions and patient co-morbidities. At the hospital where the patient’s therapy was performed, there was a theoretical framework for the management of the patient. However, due to complications the patient did not have a successful outcome.

PURPOSE

The purpose of this case report was to follow a patient who was post-lumbar surgery to determine his prognosis/the effectiveness of physical therapy intervention with subsequent complications.

CHAPTER II

CASE DESCRIPTION

Patient

The patient was a 56-year-old, Caucasian male who was diagnosed with DDD, with multilevel vacuum disc phenomenon involving every level from L1 to S1. Vacuum disc phenomenon is “accumulation of gas, principally nitrogen, in crevices within the intervertebral disk or vertebra.”^{13p.1} The patient had a previous lumbar spine surgery which gave him complete relief for his left leg pain two years prior to his return to his primary physician. The patient had an appointment with his primary physician with a chief complaint of severe back pain and spasm over his right sacral iliac (SI) joint with radiating pain into his right groin and thigh that had been getting worse over the last 6 months. The physician documented noticeable ataxic gait with his back flexed forward. Conservative treatment had failed which led to surgical intervention consisting of L1-L5 bilateral laminectomy and thecal sac decompression, L1-S1 major facetectomy and neural foraminal decompression, posterior segmental instrumentation from L1 to S1 and posterolateral arthrodesis from L1 to S1 which was performed thirteen days later.

Patient’s History and Past Medical Information

The patient’s past medical history and co-morbidities played a significant role in the patient’s current status. The patient’s past surgical history includes a left decompressive laminotomy at L2-L3 and L3-L4 with microsurgical reach over decompression of the right side

in 2012. He also had left leg fasciotomies for deep posterior compartment abscess in 2012. The patient's past medical history was significant for hypertension, dyslipidemia, dysthymic disorder, diabetes mellitus type 2, sleep apnea, obesity, diabetic peripheral neuropathy and a history of splenomegaly. The patient's family history was significant for diabetes, heart disease, stroke and ovarian cancer. The patient's current functional status prior to surgery was independent. However, he reported to his primary physician that when he walked he "felt that his legs become weaker" and had to sit down. After sitting down he stated that the pain dissipates. The patient stated that he had a history of depression which is controlled by medication. There were no other psychological concerns at that time. His behavioral risk factors were significant with a history of alcohol consumption, obesity (BMI: 37), and leading a sedentary lifestyle. Patient reports quitting all alcohol consumption one year ago for his grandson and stated no history of cigarette smoking.

The patient stated that he was currently living in a one level mobile home with his girlfriend and had three steps to enter the home with bilateral railings. Pre-surgery, the patient was not utilizing any assistive devices or equipment in the community or at home. He was independent in all activities of daily living (ADL) and was able to drive himself to and from work. The patient owned a truck washing company where he worked full time. He stated that he enjoyed spending time with his family, especially his grandson. He had a strong support system of family and friends who live locally and assisted him as needed.

Over the last 6 months the patient had underwent conservative management for his back pain. Conservative treatment included physical therapy, epidural steroid injections, SI joint injection, rest and medication. The patient failed to respond to all conservative treatments. The

patient and families goals were to decrease pain in his lower back, improve his strength and endurance, and return home independently.

Current Medications

The patient was taking Flexeril as needed for muscle spasms. Side effects of Flexeril include muscle weakness, fast/pounding or uneven heartbeats, chest pain, confusion, loss of appetite, seizures, nausea, and easy bruising or bleeding.³ The patient was aware of these side effects and was advised to notify medical staff if any of the side effects were present and medical staff would notify the physician to alter medication as needed. The patient was also taking a multivitamin and Tylenol that have been approved by his physician. Medications for other conditions include Lantus, Cephalexin, and Zoloft. Lantus was used to control his diabetes. The most common side effect for Lantus is low blood sugar. Other “symptoms include headache, hunger, weakness, sweating, tremors, irritability, trouble concentrating, rapid breathing, fast heartbeat, fainting, or seizure”.^{11p.1} The patient stated that he understood and was conscious of the signs and symptoms of hypoglycemia and would notify medical personnel immediately upon awareness of symptoms. The patient was also on Cephalexin for a bacterial infection diagnosed as MSSA (Methicillin-sensitive Staphylococcus aureus). Possible side effects of cephalexin that could affect therapy are “severe diarrhea, stomach pain and vomiting.”^{12p.1} The patient was taking Zoloft to treat his depression. Side effects that could affect therapy are “drowsiness, confusion, increased sweating and thirst, lack of energy, and overactive reflexes.”^{13p.1}

Tests and Measures Taken

Aerobic capacity and endurance were grossly assessed during bed mobility. Shortness of breath was noticed during mobility; however, the patient was also limited due to pain and

Review of Systems

Patient's cardiovascular/pulmonary system remained stable with constant monitoring using a cardiac and hemodynamic monitor. The patient exhibited a slight increase in heart rate possibly secondary to pain. His blood pressure remained controlled with medication. Oxygen saturation levels remain stable with room air, but noticeable shortness of breath with activity. The physician stated no need for supplemental oxygen during activity. Integumentary assessment was deferred due to pain. Integumentary concerns included development of sacral ulcers as well as calcaneal ulcers secondary to bed positioning. Nursing will manage integumentary concerns.

The patient appeared sleepy and lethargic upon arrival of therapy. He was grossly oriented to person and place but showed delayed processing. Due to cognitive barriers, not all systems could be reviewed accurately upon examination. Learning preferences were indeterminable due to confusion.

Musculoskeletal review was unable to accurately be assessed due to the patient becoming lightheaded while seated at the edge of the bed and not being able to effectively follow directions. The patient's primary physician documented bilateral lower extremity strength to be 5/5 prior to surgery. The neuromuscular system review showed a decrease in gross coordinated movements. The patient showed decreased balance and appeared apraxic with his body mechanics during mobility.

Evaluation

It was difficult to synthesize the examination findings due to the patient's decreased cognition. His delayed cognitive processing was his most significant impairment upon

evaluation because it affected his ability to actively participate in therapy. His second most significant impairment was pain because this decreased his willingness to participate in any activities without requiring a large amount of encouragement from medical staff and family. A problem list was made assessing the factors that affected his performance in therapy. The list included: delayed cognitive processing, inability to follow directions, poor safety awareness, pain, apraxia, fatigue, decreased ADL functioning, impaired balance, impaired trunk control and impaired endurance. Rehab potential was documented as fair.

Clinical Impression

The patient was found to be an appropriate candidate for intervention due to referral from the neurosurgeon, availability of the appropriate equipment, skills, and intervention techniques to positively impact the patient's health status. The patient was motivated to return home with the help of his family and friends' support.

Prognosis and POC (plan of care)

Examination included strength, endurance, and functional mobility assessments to determine limitations. After gathering the information from the assessments, the areas that needed improvement was noted and addressed. Prognosis was dependent on the results of the examination and the review of the medical record. Secondary complications were also a factor in the patient's prognosis. Interventions included strength and range of motion exercises, transfer and mobility training, gait training, neuromuscular re-education and patient/family education. It was anticipated that the patient would need possible interim placement for continued therapy due to cognitive delay and would likely be contact guard assist (CGA) with

mobility and transfers. The following short term and long term goals were discussed to address the patient's problem list.

Short term goals

1. Following PT intervention, the patient will complete bed mobility using proper body mechanics with stand by assist (SBA) in order to prevent secondary injuries, to be met in 1 week.
2. Following PT intervention, the patient will transition from supine (lying on his back) to sitting with proper body mechanics with SBA in order to prevent secondary injuries, to be met in 1 week.

Long term goals

1. Following PT intervention, the patient will ambulate 100 feet with a wheeled walker with CGA in order to be mobile in his home, to be met in 4 weeks.
2. Following PT intervention, the patient will be able to ascend and descend 3 steps with bilateral railings in order to get into his home, to be met in 4 weeks.

Re-examination and evaluation were initiated upon referral from physician. The patient was given the following ICD9 Code: 724.0 Spinal Stenosis, other than cervical.

CHAPTER III

INTERVENTION

Upon arrival of therapy for the initial examination the patient was in bed and appeared sleepy and lethargic. After much encouragement, the patient agreed to participate in physical therapy. The patient stated that before any activity was initiated his pain was 7 out of 10 in his low back. Patient education was given on proper bed mobility. Physical therapy assisted the patient with rolling to his right side with a maximal assist of one (MAA x1) person and with patient use of side bed rail. The head of bed (HOB) was elevated to roughly 30 degrees and the physical therapist gave maximal assistance to patient in order to transition from supine to sitting at the edge of bed (EOB). He appeared apraxic with his body mechanics during mobility. The patient displayed poor sitting balance and required moderate assistance of one person for trunk support while sitting EOB. The patient was unable to effectively follow directions in order to assess ROM and lower extremity (LE) strength. He sat at the EOB for seven minutes before he stated that he was dizzy. The patient was assisted by two medical staff back into bed where he stated that his pain was 12 out of 10. The examination was concluded due to cognitive barriers and pain.

Upon arrival of physical therapy for the second visit the patient needed encouragement to participate. He was receptive to mobilize out of bed (OOB) and to sit up in a chair in order to eat his lunch. He remained somewhat lethargic, with delayed cognitive processing. The patient stated his pain was 5 out of 10. Functional mobility was performed with the HOB elevated to 30

degrees the patient was able to transition from supine to sitting with use of side bed rail and moderate assistance of one (MOA x1) person. While sitting EOB, the patient demonstrated diminished knee extension, especially in the right knee. Ankle dorsiflexion was assessed bilaterally with no remarkable weakness. Hip flexion in seated was limited bilaterally due to pain. He then transitioned from sitting EOB to standing with front wheeled walker (FWW) with minimal assistance of 2 (MIA x2), with staff standing at his sides and holding onto the gait belt that was placed around his waist. The patient took a few steps from the bed to the chair with FWW and MAA x2 and constant verbal cuing for proper foot placement. His movement appeared ataxic and stated that his pain increased “significantly” during mobility to the chair. Patient needed verbal cuing for proper descending into chair. Patient education was given about proper transition from standing to sitting. Patient stated then that he did not want to participate in any further therapy and would like to eat his lunch.

Upon arrival of physical therapy for visit number three, the patient was lying in his bed but agreed to sit up in a chair. The patient was re-educated on bed mobility, specifically log rolling. With the HOB elevated to 30 degrees, he log rolled with MOA x1 and use of side bed rail. Patient showed improvement in bed mobility at that time. The patient then went from sitting EOB to standing with a FWW and MOA x2. He needed verbal cueing for proper hand placement on walker and full knee extension. The patient was able to take six steps from the bed to the chair with the use of a FWW and MOA x2 for safety. Slight difficulty was noted with sequencing of feet during gait which required maximal verbal cueing. At that time the patient rated his pain 10 out of 10 at the incision on his back. Patient education was provided to the patient and nursing to build patient endurance up for OOB mobility by getting up three times

daily and sitting in chair for 30-40 minutes at a time. At this time therapy anticipated need for transitional care unit (TCU) prior to discharge (DC) home when medically stable.

The patient was in bed upon arrival of physical therapy for the fourth visit. He stated that he had walked to the bathroom in the morning with his FWW but did not want to sit in his chair afterward so he returned to bed. The patient transitioned from supine to sitting EOB with MOA x1 with the HOB elevated to 30 degrees and with use of bed rail for log rolling to his side. Minimal assistance of 2 and FWW were used for transitioning from sitting EOB to standing. At this time the patient stood static for two minutes in order to use the urinal. He demonstrated a slight lean to the right due to fatigue in the right knee. The patient leaned on staff for support at this time. Next the patient ambulated roughly 20 feet with FWW and MIA x2 for safety. He demonstrated difficulty advancing the left LE during the stance phase on the right foot. He also demonstrated a step to gait pattern. One brief standing rest break was needed due to decreased endurance. The patient returned to bed and said that his pain was 10 out of 10 with some radiculopathy down the right leg. At that time the patient was slowly improving but demonstrating difficulty with gait pattern due to pain and weakness.

The next day physical therapy was notified that the patient was accepted into a TCU and the patient was discharged. The patient would continue therapy at the TCU and once medically stable would return home.

CHAPTER IV

OUTCOMES

The patient did not have a discharge evaluation done by physical therapy in order to compare initial evaluation to discharge. Because of this, initial evaluation results were compared to the fourth visit since that was his last visit. The patient was unable to perform bed mobility without MAA on the initial visit and was able to performed bed mobility with MIA on his last visit. The patient was unable to stand or walk his first visit and was able to walk roughly 20 feet with FWW and MOA x 2. The patient showed slight improvement with mobility and cognitive ability. Each day after therapy the patient would tell physical therapy that he was grateful for them. The patient did not meet any of his short or long term goals before being discharged. Although the patient needed encouragement to participate in therapy, he did not have any compliance issues.

CHAPTER V

Re-Evaluation

Approximately 10 days later the patient returned to the hospital to have the staples in his back removed. During this time the physician documented that the patient appeared “quite confused and there was report of the patient having some bilateral lower extremity buckling for which the patient was transferred to emergency department where he was seen by” a physician “who reports on his examination patient having normal strength in bilateral lower extremities.” The patient then underwent a magnetic resonance imaging (MRI) of the lumbar spine. The physician documented that the MRI “images were inadequate and a subsequent computerized tomography (CT) of the lumbar spine was done that shows a frankly obvious retropulsed inferior body pedicle complex and evidence that the L1 screws were backing out.”

Orders for physical therapy were received and acknowledged at this time. The patient was on bed rest per neurosurgery. The plan at this time was to monitor his status and initiate care when appropriate.

That same day, nursing documented that the patient ceased ability to move bilateral lower extremities. The patient was given a pre-operative diagnosis at this time of paraplegia secondary to L1 instrumentation failure and myelographic block at L1. The patient was taken in to the operating room that same day for a L1 pedicle screw removal decompression ventrally at L1, extension of construct to T12 and T11 bilateral pedicle screw at T11 and T12.

Physical therapy received orders at this time that patient may be up with therapy after the patient's thoracolumbosacral orthotic (TLSO) brace arrives. His TLSO was to be worn at all times. The patient was alert and orientated in bed upon arrival of therapy. He stated his pain was eight out of 10 in his low back at rest. The patient displayed no AROM in bilateral LEs but PROM within functional limits (WFL). PROM was performed to the patients' bilateral hips, knee and ankles in all planes. Due to absent AROM the patient was given 0/5 LE strength, bilaterally. The patient was a dependent of three, transfer from supine to sitting EOB. He sat EOB for approximately four minutes with assistance of two for trunk support. The patient stated that his pain in his low back, increased significantly during mobility. Patient education was given at this time about the importance of postural changes in order to reduce his risk for sacral and heel ulcers.

The patient was given the following short and long term goals according to his problem list.

Short term goals:

1. Following PT intervention, the patient will be able to tolerate transferring with slide board to the Barton chair with assist of 4, in order to reduce risk for ulcers, to be met in 2 days.
2. Following PT intervention, the patient will be able to perform bed mobility/rolling with MOA x 2 in order to become more independent, to be met in 1 week.
3. Following PT intervention, the patient will be able to transition from supine to sitting EOB with MOA x2 in order to progress to standing, to be met in 1 week.

Long term goals:

1. Following PT intervention, the patient will tolerate sitting EOB for 15 minutes with CGA in order to work on trunk stability to be met in 3 weeks.
2. Following PT intervention, the patient will be able to go from sit to stand with MOA x 2 in order to progress to walking to be met in 3 weeks.

The POC included the following: therapeutic exercise (strength/range of motion), therapeutic activities (transfer training/mobility), neuromuscular re-education and patient and family education. It was anticipated the patient would need inpatient rehabilitation when medically stable.

Intervention

Upon arrival of physical therapy for his second visit the patient was sitting in bed with the HOB elevated to roughly 70 degrees and his TLSO brace on. The patient was very tearful at the beginning and end of therapy but stated that he was appreciative for the care that he had been receiving at the hospital. The patient was transferred supine onto a slide board and then to the Barton chair. He was a total assist (TOA) x4 and a fifth person assisted the patients LE's due to loss of motor control. The patient stated that he had increased pain once up in the Barton chair but tolerated sitting in the chair with the trunk support tilted back and his legs reclined up. The patient was unable to contract muscles of bilateral LE's but was able to feel light touch. PROM was done to bilateral LEs in all planes. The patient stated that during hip movement (flexion mainly) there was an increased burning sensation from his gluteals to the popliteal space behind his knees. Patient was educated on sitting up in the chair for 30-45 minutes at a time in order to decrease his chances for ulcers.

The next day the patient was lying supine in bed upon arrival of physical therapy. The patient appeared to be confused at times asking where he was. He was agreeable to participate in therapy and stated his pain was 7 out of 10 at rest. The patient was a TOA x4 for rolling and transitioning to sitting EOB. The patient sat EOB for approximately five minutes with MAA x 2, and demonstrated poor sitting balance and continued to show no active movement in both LEs. Passive range of motion was performed to bilateral LEs in all planes when the patient returned to supine. The patient began to grimace and cry with activity due to pain. The patient's family mentioned to physical therapy at this time the possibility of the patient being transferred to a spinal cord rehab in another state for specialized therapy. The family told physical therapy that they would keep all of the medical staff informed if the patient was accepted into the spinal cord rehab.

The following day the patient seemed to be in better spirits and was agreeable to participate in physical therapy. He stated that his pain had decreased to 5 out of 10 at rest. The patient was a TOA x 5 from the bed to the Barton chair and was left in a reclined sitting position. The patient was grimacing and holding his breath during the transfer and said that his pain was 10 out of 10. The family informed therapy that the patient would be going to the spinal cord rehab within the next week.

The next day physical therapy went to check on the patient and his room was empty. After a dialogue with nursing, therapy was informed that the patient was accepted to the spinal cord rehab and he had already been discharged.

Outcomes

The patient was re-evaluated after his second surgery and was diagnosed with paraplegia. At the last session of therapy the patient still did not have any active movement in his lower extremities. The patient was limited in assisting during transfers due to pain that continued throughout all therapy sessions. The patient did not meet any of his goals due to short stay at the hospital. The patient was very appreciate of therapy but was tearful during many sessions about lack of progress. The patient seemed hopeful for being transferred to a specialty rehabilitation center.

CHAPTER VI

DISCUSSION

Outcomes were skewed due to set backs and complications. Due to the patient's decreased cognitive abilities and pain, the patient was unable to participate in therapy to his full potential. When the patient was discharged after the first surgery his recovery was slow but he was progressing. Then he regressed due to instrumentation failure. This set back his recovery time because of the need for a subsequent surgery. Following the second surgery the patient was only seen for four visits before he was transferred to a spinal cord rehabilitation center. During this time the patient did not make any noticeable progress due to pain. More documentation needs to be recorded in order to determine how common failed back surgery occurs and what the typical outcomes are for these patients.

Reflective Practice

Reflecting back on the care for this patient, there are a few changes that could have been made. If therapy would have had prior knowledge of the patient discharging after both surgeries, therapy would have been able to perform a discharge examination which would have allowed therapy to compare those results better to the initial results. The POC would have been altered slightly as well if therapy would have known how short of a stay the patient would be having in the hospital. Because this patient was medically unstable, all medical disciplines would be beneficial to consult in order to ensure this patient had the best care possible.

I think that physical therapy was beneficial for this patient after his first surgery because we were able to teach him proper bed mobility, transfers and gait. When the patient lost function in his lower extremities after the second surgery, physical therapy focused on PROM and transfers to the Barton chair. Although physical therapy was beneficial to him after his second surgery, nursing could have done PROM and transfers with him. Due to the patient being overweight, he needed multiple medical staff to assist with transfers which is why physical therapy, occupational therapy and nursing would typically co-treat. It was never discussed if the instrumentation failure could have been caused from movement, surgical complications or other reasons.

Considering the movement towards pay for performance for physical therapy services the patient paid roughly \$135 out of pocket for the therapy that he received in the hospital. Considering the fact that the patient did not make noticeable progress during his time spent at the hospital one could say that the cost was not reasonable based on the patient's outcomes. The patient's costs could have been reduced by having nursing perform PROM and transfers to the Barton chair instead of billing those transfers for therapeutic activity. However, the patient did maintain good skin integrity from position changes and prevented contractures from physical therapy. The patient received proficient medical care and was very motivated to improve. The reason for lack of improvement was due to an undeterminable factor that physical therapy and the patient were unable to control. Continuing education is important in order to determine beneficial interventions for patients with complex back surgeries as well as to decrease the likelihood of instrumentation failure.

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