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Inpatient Physical therapy Management of Patient with Post-Operative Quadriparesis Following Posterior Cervical Lamenectomy and Fusion: A Case Report

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INPATIENT PHYSICAL THERAPY MANAGEMENT OF PATIENT WITH POST-OPERATIVE QUADRIPARESIS FOLLOWING POSTERIOR CERVICAL LAMINECTOMY AND FUSION: A CASE REPORT

by

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This Scholarly Project, submitted by Kayla Ann Christopherson 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 Faculty Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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ABSTRACT

Background and Purpose: Spinal hemangioblastoma are benign tumors that compress the surface of the spinal cord. Surgical resection of the hemangioblastoma with a posterior cervical laminectomy and fusion technique is one treatment option. This form of treatment can lead to poor outcomes such as post-operative quadriparesis although rare. The following case study depicts physical therapy interventions use to treat a patient with post-operative quadriparesis for posterior laminectomy and fusion of C6-T2.

Case Description: The patient was a 77-year-old female with complex past medical history and multiple comorbidities. She received inpatient physical therapy for 31 days before transferring to a skilled nursing facility.

Interventions: Physical therapy interventions included traditional lower extremity strengthening exercises, gait training, and functional task training.

Outcomes: The patient made improvements towards her goals and demonstrated reduced dependence with the use of adaptative equipment. However, she was unable to achieve her main goal to return to her prior level of function and previous living environment.

Discussion: The patient made advancements during her inpatient physical therapy treatments but was unable to regain functional independence during her stay. She also reported improved quality of life on the outcome measures. However, further research is needed for a better

understanding of effective treatment interventions and favorable outcomes with this patient population.

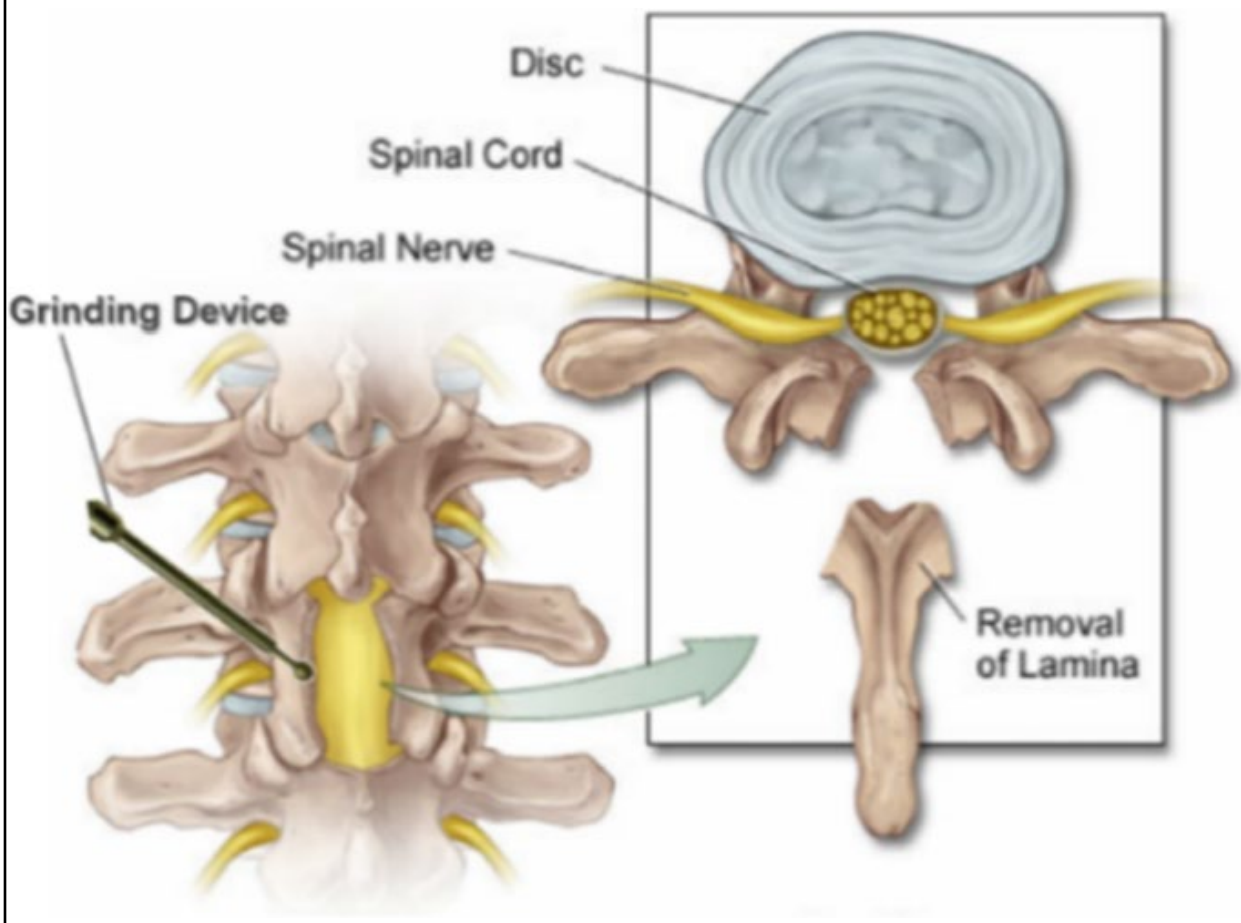
CHAPTER I

BACKGROUND AND PURPOSE

Spinal hemangioblastoma are compressive benign tumors that are usually located on the surface of the spinal cord. Although rare, accounting for 2% to 6% of all spinal cord tumors, these benign tumors may have significant effects on the patient's function and quality of life.[1] They may develop sporadically or be genetically linked to von Hippel-Lindau (VHL) disease.[1] Typically, they are slow growing in nature and require treatment as they become symptomatic. Common symptoms reported include pain, sensory changes in arms or legs, clumsiness, weakness, difficulty with gait, and/or bowel and bladder incontinence. The exact symptoms are dependent on the tumor's size and location. Hemangioblastomas are diagnosed using magnetic resonance imaging (MRI) and computed tomography (CT). Resection of the tumor using surgical techniques to completely remove the tumor and preserve neurological function is determined by the treating neurosurgeon and generally is the treatment of choice.[1,2]

Historically, patients have poor outcomes following removal of cervical spine growths.[3] However, the exact clinical incidence of complications following surgical intervention is poorly addressed in the literature.[3,4] Posterior cervical laminectomy and fusion decompression surgery was indicated for the removal of the patient's hemangioblastoma as determined by her team of doctors. Posterior cervical laminectomy surgery involves removing a small piece of the vertebra called the lamina. Removing the lamina allows for decompression of the spinal canal and to relieve pressure on the spinal cord or nerves.[5] See Figure 1 for lumbar laminectomy graphic.[6]

Figure 1. Lumbar Laminectomy



Spinal fusion was combined with the laminectomy to provide stability to the cervical spine after multiple levels of lamina were removed and the tumor had been resected. During the fusion two or more vertebrae are permanently joined together, via bone grafts and/or metal rods and screws to add stability to the spinal structure.[5]

Post-operative quadriparesis following posterior cervical laminectomy and fusion of C6 to T2 is a rare but devastating complication. It can cause permanent injury and disability, including upper and lower extremity weakness, inability to ambulate, and loss of fine motor skills. The condition is poorly reported; however, one study suggested the incidence of post-operative quadriparesis to be between 1% to 3%.[3]

The case report's purpose is to utilize the examination and intervention of the given patient as a guide to expanding and developing evidence for improved clinical practice. It is anticipated that the completed report will show an example of the care provided for a patient with post-operative quadriparesis following posterior cervical laminectomy and fusion of C6-T2. Through the application of the evidence-based examination and intervention techniques, the results of this case report could potentially improve client outcomes for physical therapy services. This case report may be shared within the physical therapy community to provide additional information and ideas for treating other patients with similar diagnosis.

CHAPTER II

CASE DESCRIPTION

The patient was a 77-year-old female with a complex medical history involving multiple comorbidities affecting her condition. Her past medical history included aortic stenosis, osteoarthritis, type 2 diabetes mellitus, diverticulitis, hypertension, hyperparathyroidism, and morbid obesity. The tumor was discovered coincidentally during an x-ray image of the patient's chest for an unrelated condition. With further diagnostic examination and tools the tumor was specifically located between C6 and T2 spinous processes. The patient was made aware of her benign tumor (hemangioblastoma) and the recommended surgical intervention. Prior to surgical intervention, the patient reported changes in sensation, finger dexterity, and lower extremity weakness impacting her normal activities of daily living.

She arrived at the inpatient swing bed facility one month following surgical resection of hemangioblastoma with cervical laminectomy and posterior fusion. The patient presented with quadriparesis affecting her right upper and lower extremities greater than left upper and lower extremities. After initial processing by nursing, the patient was cleared for physical therapy to evaluate and treat. A thorough review of systems was conducted with noted complications involving the musculoskeletal, integumentary, and neurological systems. The patient's limited mobility indirectly affected her cardiopulmonary system, reducing her activity tolerance, leading to increased shortness of breath. Her musculoskeletal and neurological systems were negatively impacted following surgery with noted weakness and sensory changes in both upper and lower

extremities. The patient also had increased skin breakdown and risk for pressure injuries related to poor mobility and incontinence.

A detailed history was provided by the patient and her oldest daughter that had accompanied her during transfer to the facility. Her home environment was a second-floor apartment with elevator access; however, the apartment would not be suitable for a wheelchair. Although she lived with her son, she had limited support at home as he worked long hours and would be unavailable to provide the necessary assistance for the patient at home. Prior to surgery, the patient was living modified independently with use of a front-wheeled walker for community ambulation. She reports that she has not been able to maneuver stairs or remain standing longer than 15 minutes due to weakness and knee pain for the past 6 months. Her goal was to return to her prior living environment and ambulate with a front-wheeled walker. Currently, the patient's main deficits included pain, weakness, inability to manipulate objects with hands, bowel and bladder incontinence, inability to ambulate, and decreased balance.

Examination

The patient was alert and orientated throughout the examination with appropriate responses to questions and instructions. During the examination the patient's range of motion (ROM), gross strength, transfers, and level of assistance was assessed. Initially the patient was lying supine in bed with head of bed elevated when physical therapy arrived for examination. Physical therapy and occupational therapy completed a combined examination of the patient due to limited endurance and tolerance of patient. Physical therapy focused on lower extremity function and mobility while occupational therapy assessed upper extremity function. The patient was pleasant and motivated to engage with therapy.

Gross range of motion of both lower extremities was assessed with the patient in supine.

The patient's complete range of motion measurements are located in Table 1 below for reference. Patient presented with limited range of motion on both lower extremities; however, she had greater deficits on the right compared to left lower extremity. Her main deficits on the right were ankle dorsiflexion, knee flexion, hip abduction, and hip flexion. The limitations in range of motion would affect the overall function of the patient including bed mobility, transfers, standing, and gait.

Table 1: Range of Motion Measurements

	Right Lower Extremity	Left Lower Extremity
Ankle Dorsiflexion	Neutral	20 degrees; WNL
Ankle Plantarflexion	Within normal limits	Within normal limits
Knee Flexion	Active: 45 degrees Passive: 87 degrees	Active: 100 degrees Passive: 104 degrees
Knee Extension	Within normal limits	Within normal limits
Hip Abduction	Active: 12 degrees Passive: 43 degrees	Active: 27 degrees Passive: 45 degrees
Hip Adduction	Within normal limits	Within normal limits
Hip Flexion	Active: Unable Passive: 75 degrees	Active: 40 degrees Passive: 75 degrees

After range of motion was established, gross strength of the patient was assessed. However, due to patients limited mobility, standardized positioning was deferred for some strength testing procedures. As with range of motion, the patient's right lower extremity was more affected than left lower extremity. Her largest deficits were active hip abduction, knee extension, knee flexion, and dorsiflexion on the right. See all strength measurements in Table 2 below.

Table 2: Strength Measurements		
	Right Lower Extremity	Left Lower Extremity
Hip Flexion	2-/5	3-/5
Hip Abduction	0/5	2/5
Hip Adduction	2+/5	2+/5
Knee Extension	1/5	4-/5
Knee Flexion	3/5	4/5
Ankle Plantarflexion	2/5	2+/5
Ankle Dorsiflexion	0/5	3/5

Lastly transfers were observed, and assistance levels were obtained. The patient was able to roll from supine to side-lying in bed modified independently with use of bed rail. However, she was unable to go from side-lying to sitting on the edge of the bed without moderate assistance x 1. She needed maximum assistance x 2 to maintain a sitting position at edge of the bed. During the initial examination standing and ambulation were not completed due to the patient's inability to perform sit to stand transfer without reliance of a mechanical lift for assistance. Her limited mobility and strength put the patient at greater risk for pressure injuries, falls, and reduced independence.

Evaluation, Diagnosis, and Prognosis

Following the initial examination, the patient was determined to be appropriate for skilled physical and occupational therapy. The frequency and duration of physical therapy services was determined with use of facility policies and procedures at 2 times per day, 5 days per week for at most 12 weeks. The patient was scheduled to see occupational therapy 1 time per day, 5 days per

week for maximum of 12 weeks to work on her upper extremities, hand dexterity, and activities of daily living. A problem list was created for the patient to identify deficits to be addressed through skilled physical therapy interventions. The problem list included pain, decreased strength, decrease range of motion, reduced balance, gait abnormalities, reduced endurance, limited mobility, incontinence, pressure injuries.

Based on the problems identified above the patient's potential for reaching her goal to return to her prior level of function and living environment was thought to be a challenge, however, not impossible. Therefore, goals were set with the expectations of returning the patient to her prior living environment, if possible, although it may require adaptive or assistive equipment to achieve. The results of the examination and the potential for improvement were discussed with the patient. The patient verbalized understanding and willingness to work with therapy to regain as much function as possible.

Short- and long-term goals were established at 6 and 12 weeks respectively. The patient's short term goals were as follows: 1) Roll in bed modified independently with rails to aid with care 2) Perform sit to stand and stand to sit with minimal assistance to reposition 3) Sit statically on edge of bed unsupported without difficulty 4) Transfer from wheelchair to bed and bed to wheelchair with moderate assistance 5) Ambulate 50 feet with moderate assistance x 2 6) Stand modified independently for 5 minutes. Long term goals advanced upon the short-term goals. Transfer goals with level of assistance were made to modified independent or independent for patient to be deemed safe to return home. Distance and time for patient to stand and ambulate were also increased for patient to be safe in community.

The patient was determined to be appropriate for intervention after the evaluation was complete. Intervention focus would be to improve patient's mobility, function, and quality of life to reach patient and therapy goals. Due to the complexity of the patient's condition and unknown prognosis for recovery from surgical intervention, a secondary plan was put in place. If needed the intervention program would be revised for the patient to achieve the greatest independence with use of a wheelchair if patient was unable to regain the ability to ambulate. Patient was made aware of plan of care and agreed to continue with therapy.

CHAPTER III

INTERVENTION

Research is limited in treatment guidelines for patient with post-operative quadriparesis following resection of hemangioblastoma using a posterior cervical laminectomy and fusion. However, guidelines for other spinal cord related injuries may be useful to establish rehabilitation interventions. Consortium for Spinal Cord Medicine (CSCM) guidelines strongly support interventions including range of motion, strengthening, transfer training, locomotion, retraining for activities of daily living to assist recovery.[7] Physical therapy interventions were chosen to address the patient's functional deficits and make advances to reach patient goals. Interventions included traditional lower extremity strengthening exercises, gait training with use of a mechanical lift, and functional task training. Functional task training that was performed included bed mobility, sitting balance, reaching activities, and standing exercises.

Therapy sessions were administered two times per day, once in the morning and once in the afternoon. Occasionally, physical therapy sessions would be combined to co-treat with occupational therapy when appropriate. Each therapy session lasted approximately 45 to 60 minutes depending on patient tolerance and interventions. Sessions were conducted in various locations including the patient's room, the facility hallways, and therapy department's gym. Patient consent was obtained prior to each session through verbal consent. Education about the patient's condition and selected interventions were provided to patient and family throughout treatment.

Lower extremity strengthening exercises were performed in both supine and sitting positions on either the hospital bed or the plinth. Exercises performed in supine included quadricep isometrics, straight leg raises (SLR), short-arc quadricep extensions, hamstring isometrics, gluteal isometrics, hip abduction, and ankle pumps. Sitting exercises included alternate marching, long-arc quadricep extensions, heel raises, and toes raises. Each exercise was performed for 10 repetitions on bilateral lower extremities with appropriate rest between exercises.

Functional training was performed following strengthening exercises. A variety of situations were used to simulate possible task and environments that the patient may encounter. Patient and therapist safety was the main priority. Gait belts and appropriate lifting mechanics were used during all functional training. Training included bed mobility going from supine to sitting and vice versa. The patient initially required assistance from the therapist to complete the task but with proper education the patient improved to perform the task modified independent with use of bedside railing. Once the patient was in a seated position, functional tasks were performed to work on sitting balance and reaching activities. As the patient's stability increased, she was challenged with reducing the stability of the sitting surface. The first progression was sitting on a balance disc and then to an exercise ball both shown in Figure 2. From a sitting position the patient worked on completing sliding board transfer to and from wheelchair. A sliding board transfer is a method for transferring a patient who is unable to fully bear weight on lower extremities using a smooth tapered board placed under the patient's thigh, allowing movement from surface to surface.[8] Along with sliding board transfer, sit to stand transfers were performed with various equipment. Therapist dependent transfers and mechanical lift assisted transfers were utilized to get the patient standing. Lastly, functional gait training with use of a

mechanical lift, Hillrom Golvo 9000®, was performed.[9] The Golvo® lift allowed for partial weight bearing to be tolerated through the lower extremities without reliance on the upper extremities to bear weight. Along with partial weight bearing, the physical therapist was able to assist with tactile cues and manual control on right lower extremity. Despite patient motivation and effort, she was unable to perform gait without the assistance of a mechanical lift during our sessions.

FIGURE 2: Balance Disc and Exercise Ball

Balance disc on left and exercise ball on right.[10,11]

CHAPTER IV

OUTCOMES

The patient was seen in the swing bed hospital unit for 31 days and completed a total of 62 physical therapy treatment sessions. Objective and subjective outcome measures were used to evaluate the effectiveness of physical therapy. Although her outcomes were not favorable to return to her prior level of function or previous living environment, she was able to make functional gains to reduce dependence with the use of adaptative equipment. The patient also reported improved quality of life on the Short Form 36 (SF-36). Medical outcomes study SF-36 is a patient-reported outcome measure that measures health status and health-related quality of life. The SF-36 is recommended by the American Physical Therapy Association (APTA) for patients with spinal cord injury.[12]

Objective measures used to judge effectiveness of physical therapy treatment included ambulation distance and level of assistance. The patient completed ambulation with assistance of a mechanical lift. She was able to increase her tolerance for ambulation from a few steps to 75 feet during her stay; however, she was unable to perform ambulation without the assistance of a mechanical lift. Patient was able to navigate a wheelchair with adaptive grip accessories starting at 10 feet and advancing to over 300 feet. Shove-a-Lugs®, AliMed, grips allow the person to use the palms of their hands to push the wheelchair rather than requiring grip to push the wheel.[13] This equipment was important for this patient due to her grip weakness. The patient decreased her level of assistance required during several transfers. With side-lying to sitting transfer she

advanced from moderate assistance x 1 to modified independent with use of bed rail. Also, she advanced to being able to maintain sitting balance independently on multiple surfaces compared to needing maximum assistance x 2. At evaluation the patient was unable to perform sit to stand without the use of a mechanical lift. During sessions the patient went from maximal assistance x 3 to perform sit to stand transfer to maximal assistance x 2 and at best moderate assistance x 1. In our sessions, she was never able to perform the transfer without assistance.

Although the patient made advances to decrease level of assistance and increased independence, she was unable to reach requirements for her to be safe independently in her prior living environment. After difficult conversations with the patient and her family about her outcomes and expected recovery, the focus was then shifted to promoting the best quality of life and greatest level of independence possible with adaptive equipment and devices. At this point due to hospital policies for skilled services, the patient was transferred to a skilled nursing facility to continue her recovery.

CHAPTER V

DISCUSSION

While physical therapists want the best outcomes for their patients, sometime outside factors and comorbidities can inhibit the overall success. In this case, the patient was able to meet some of her short-term goals established. However, all her long-term goals were unresolved at the time she transferred to the skilled nursing facility. The patient's main goal to return to her prior living environment was not achievable due to her limited independence and concern for her safety without assistance. The patient had a multitude of factors working against the achievement of her goal to return to her prior living environment including limited family support, lack of accessible housing, and comorbidities. Perhaps the largest barrier for the patient was her right knee pain due to degenerative arthritis reducing her tolerance for standing and walking activities.

While she was unable to achieve her main goal, implementation of lower extremity strength and functional training may have helped the patient progress towards greater independence. The patient was able to advance bed mobility to modified independence with use of bed rails. Improved bed mobility where the patient can adjust positioning themselves may reduce the risk for developing pressure ulcers.[14] Secondly, sliding board transfer training assisted the patient with the skills to move herself between her bed and wheelchair. Once in the wheelchair the patient was able to navigate short distances on level surfaces with the use of adaptive grip equipment. The patient also improved in her self-reported quality of life with implementation of physical therapy interventions. Through this experience, I learned that

promoting the greatest amount of function and independence possible will be beneficial to the patient.

Reflective Practice

Although this case report provides valuable information regarding possible intervention strategies, there are some limitations to the report. It would be beneficial to continue recording the patient's recovery as she continues with therapy after being transferred into the skilled nursing facility. Her team of doctors reported that recovery can continue for up to one year after injury. Along with the limited duration, the patient was treated by multiple physical therapist and physical therapist assistants during her treatment sessions. Each therapist uses slightly different intervention procedures that may affect the consistency and reliability of the patient's outcomes.

Another key element absent during the patient's rehabilitation process was documentation of specific progress assessments. Some additional changes that may be beneficial would be reevaluating range of motion and strength during progress notes. The progress notes were completed every tenth visit and may provide a more detailed picture of patient progression with the additional objective measures recorded. Some additions to the initial evaluation I would find beneficial would include assessing patient sensation and the use of a functional scale to determine improvement in the lower extremity may be useful. For example, using the Lower Extremity Functional Scale (LEFS) may have provided greater insight to the patient's function at different stages in her rehabilitation process.

Overall, many elements must be present in a successful rehabilitation program. While this patient may have not been able to fully achieve independence at her prior level of function, she did make advancements and improve her quality of life. Many valuable lessons were learned through this case report and may be useful for future research. One area that may be beneficial

for advancing future research in would be the use of different standing lifts or devices with gait training in a quadriparesis population. In the end, I am grateful for the experience with my patient and am hopeful that this case report may be beneficial for other clinicians towards the development of another individual's physical therapy experience.

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