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Utilization Of Task-Oriented Training To Restore Independence In A Patient With Encephalitis In The Intensive Care Unit: A Case Report

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The patient gave consent to participate in this case report and signed informed consent paperwork allowing use of medical information. The patient received a copy of the paperwork as well as information on the Health Insurance Portability and Accountability Act.

ABSTRACT

Background and Purpose: Bacterial meningitis is acute inflammation of the meninges which can result in significant morbidity and mortality. There are 15,000 to 25,000 cases of bacterial meningitis in the United States yearly and it is one of the top ten causes of infection-related deaths worldwide. Bacterial Meningitis is commonly complicated by encephalitis. The purpose of the case report is to describe physical therapy (PT) rehabilitation in the intensive care unit (ICU) with the goal of increasing the independence of the patient, diagnosed with encephalitis secondary to bacterial meningitis, to prior level of function through task-oriented training in order to be safely discharged to an inpatient rehabilitation unit (IRU).

Case Description: The patient was a 52-year-old female who was transferred to the ICU with encephalitis secondary to pneumococcal meningitis. The patient presented with generalized weakness, deconditioning, impaired cognition and problem solving, impaired balance, dizziness that interfered with function, and limited independence with all functional mobility. Task-oriented training was utilized to combat the patient's limitations, including bed mobility, transfers, and ambulation over eight non-consecutive PT sessions.

Outcomes: After eight out of eleven scheduled PT sessions, the patient progressed from maximum assistance of two people for all functional mobility tasks (bed mobility, transfers, ambulation) to minimal assistance of one person.

Discussion: The use of task-oriented training appears to have been beneficial in decreasing the patient's burden of care as she was discharged from the ICU and transferred to the IRU. Future research is required as there is limited evidence on rehabilitation interventions to treat encephalopathy secondary to bacterial meningitis, as well as guidance in predicting the PT prognosis of these patients in the ICU.

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BACKGROUND and PURPOSE

Bacterial meningitis is a serious disease that causes acute inflammation of the meninges, the lining of the brain and spinal cord, which can result in significant morbidity and mortality.[1] There are 15,000 to 25,000 cases of bacterial meningitis in the United States yearly and it is one of the top ten causes of infection-related deaths worldwide.[1] Bacterial meningitis is commonly complicated by encephalitis, inflammation of the brain parenchyma.[1] Bacterial encephalitis occurs at a lower incidence rate than viral encephalitis.[1] Thirty to fifty percent of survivors of bacterial encephalitis sustain neurological sequelae such as difficulty concentrating, behavioral disorders, speech disorders, and memory loss.[1] There is very limited research on the prognosis of these patients and their return to prior level of function (PLF).

McCulloch[2] analyzed the ability of patients (n=50) with acquired brain injuries, such as encephalitis, to perform dual task activities. The study revealed that impairments in cognition and attention have a significant effect on postural control and mobility.[2] Arousal, attention, and cognition were linked to functional limitations in self-care, home management, and fulfillment of life roles in the community and leisure pursuits.[2] The effectiveness of task-oriented approach versus interventions that directly addressed cognitive impairments was explored. It was discovered that the task-oriented training was easier to implement since it included interventions combining motor and cognitive tasks together.[2]

In a prospective study by Mailles et al.,[3] researchers assessed the long-term sequelae and quality of life of 167 patients who were diagnosed with encephalitis. After one year from onset, 87% of 63 previously employed patients managed to return to work with 34% requiring adaptations of their work tasks. The most frequent symptoms the patients struggled with were difficulty concentrating, behavioral disorders, speech disorders, and memory loss.[3] When assessing quality of life, researchers discovered 56.8% reported emotional troubles, 46.8% felt

depressed, and 16.8% reported difficulties maintaining normal relationships.[3]

This case report is needed as there is very limited literature on rehabilitation interventions to treat encephalitis secondary to bacterial meningitis in the ICU. The purpose of this case report was to describe PT rehabilitation in the ICU with the goal of increasing the independence of the patient, diagnosed with encephalitis secondary to bacterial meningitis, in order for her to be safely discharged to the IRU.

CASE DESCRIPTION

Patient History and Systems Review

The patient gave written consent to participate in this case report and received a copy of the consent form. The patient was a 52-year-old female who was admitted to the ICU with encephalitis secondary to bacterial meningitis, and this case report describes the patient's PT episode of care that took place in the ICU prior to her discharge to the IRU. Prior to admission to the ICU, she was independent at home and in the community, lived alone in a single level home, and worked full-time as a Certified Occupational Therapy Assistant (COTA). Although separated by distance from her family she had a network of supportive friends and neighbors nearby.

It was unknown how the patient contracted bacterial meningitis. According to the patient's power of attorney, the patient had a six-month history of fatigue, shortness of breath, vertigo, generalized muscle and joint pain, as well as severe right ear pain prior to her admission to her local hospital. She arrived in the ICU intubated, unresponsive, and paralyzed requiring a ventriculostomy placement to manage her intracranial pressure and cerebral edema. Upon arrival, she received a Glasgow Coma Score (GCS) of 3 (*deep coma*). The GCS, a 15-point scale with scores ranging from 3 to 15, can be used as part of an initial assessment of a person's level of consciousness after injury, or to monitor change in consciousness over time.[4] Refer to Table 4

for GCS scores and psychometric properties.

The patient's past medical history included alcohol abuse, obstructive sleep apnea, glucose intolerance, anxiety, and remote history of drug abuse. Please refer to Table 1 for her list of inpatient medications. In addition to PT, she received services from occupational therapy, speech therapy, respiratory therapy, pharmacy, case management, nutrition/dietary counseling, and cardiology.

The patient was not medically stable for PT evaluation and treatment until six days after admission. Based on the nursing staff's daily assessment of the patient's consciousness, the patient received a GCS score of 15 (*fully awake*) on the day of her PT initial evaluation (IE). She was oriented to person, place, and time, but unaware of the situation. Please refer to Table 2 for results of her systems review. The patient's chief complaints included dizziness and headaches. The patient's primary goals for PT were to make a full recovery and return back to personal and occupational responsibilities.

Clinical Impression 1

Following a review of the patient's history, her primary impairments included mobility, cognition, balance, endurance, and strength as a result of encephalitis secondary to bacterial meningitis. There were no differential diagnoses to be addressed upon IE. Planned tests and measures included the GCS and performance-based tests to assess: 1) lower extremity (LE) and upper extremity (UE) gross strength; 2) LE and UE gross range of motion (ROM); 3) bed mobility; 4) transfers; and 5) sitting and standing balance. Her blood pressure (BP), oxygen saturation (SpO2), and respiratory rate (RR) were initially assessed and subsequently monitored via NDS LifeVue™ Monitoring Display (Ampronix, Irvine, CA).

The patient remained an appropriate candidate for the case report since her rehabilitation prognosis was good as her medical status was steadily improving. Her background as a COTA

was hypothesized to increase her motivation and adherence to skilled PT services.

Examination – Tests and Measures

Test and measures performed during the PT IE were performance-based tests in order to establish short and long-term goals to return her to her PFL. A performance-based test involves observing the patient during the performance of an activity in order to assess limitations and restrictions.[5] The performance-based tests assessed: 1) LE and UE gross strength; 2) LE and UE gross ROM; 3) bed mobility; 4) transfers; and 5) sitting and standing balance. The patient was asked to perform the activities and was assisted by the PTs when necessary. She was unable to isolate specific movements during the IE; thus, traditional manual muscle testing was not applicable. According to O'Sullivan,[6] an estimation of strength can be observed through active movements during functional activities. Please refer to Table 3 for results of the tests and measures.

When asked to perform a task, the patient demonstrated delayed command following and required increased time to complete tasks. When asked to sit at the edge of the bed, the patient attempted to accomplish the task, but demonstrated impaired motor control and required two therapists for maximum assistance. Once in sitting, the patient demonstrated impaired sitting balance by demonstrating ballistic movements in all planes of motion. She required contact guarding posteriorly and anteriorly. According to Verheyden et al.,[7] sitting balance is prerequisite for standing and ambulating. During her transition from supine to sitting, she demonstrated a decrease in BP accompanied by dizziness and the desire to lie back down. For the patient's safety, she was not progressed to standing during the PT IE.

Clinical Impression 2

The initial clinical impression was confirmed based on the examination data. It was originally hypothesized that the patient would at least be able to stand with assistance; however,

she was unable to maintain sitting balance due to her severe dizziness and was therefore unable to progress to standing. She presented with generalized weakness, deconditioning, impaired cognition and problem solving, impaired balance, dizziness that interfered with function, and limited independence with all functional mobility that were all consistent with initial clinical impression.

Despite her mobility and cognitive deficits, she was still an appropriate candidate for the case report as it was believed she would benefit from ongoing skilled interdisciplinary therapies to progress with mobility and function in order to return to PFL. The decision was to proceed with PT services.

Based on the patient's medical status, three medical ICD-10 codes were chosen. The primary ICD-10 code was G00.9, *Bacterial meningitis, unspecified*. The secondary code chosen was D47.3, *Thrombocytosis*. The tertiary code chosen was F41.9, *Anxiety disorder, unspecified.* There were no rehabilitation ICD-10 codes selected.

The patient's medical prognosis was good, but her PT prognosis was unable to be determined. Prior to her infection, she worked full-time as a COTA and was completely independent at home and in the community. Her age and PFL were predicted to positively affect the patient's prognosis. However, her impaired cognition and motor control, and acuity of her illness were limiting factors to determine a prognosis. Her impaired cognition would likely make administering PT interventions challenging. According to Mailles et al.,[3] 25% of patients with encephalitis previously employed were unable to return to work and 34% of those who resumed work required adaptation of their tasks.[3]

Plan for referral included anticipated discharge from the ICU to IRU once she was medically stable. In addition to PT services, she received services from occupational therapy, speech therapy, respiratory therapy, pharmacy, case management, nutrition/dietary counseling,

and cardiology. Plans for referral and consultation took place daily within the patient's healthcare team during rounds and as often as needed.

Additional testing and follow-up evaluation of outcomes would vary each therapy session. The patient would undergo daily assessments to document any progress or regression regarding her functional mobility as it was expected to fluctuate based on her medical and mental status. An intervention plan was developed during the IE with the primary focus to regain her independence with bed mobility, transfers, and ambulation through functional training task-oriented interventions. The main goal was to increase the patient's independence to reduce the burden of care in order to have her transferred from ICU to IRU. Short and long-term goals were created at the IE, but needed to be modified throughout the patient's course in ICU. See Table 5 for short and long-term goals.

Intervention

Coordination and communication of the patient's care were interdisciplinary and occurred daily. Progress notes were updated by hospitalists which were essential updates of the patient's medical status. All documentation took place on CernerWorks (Cerner, Kansas City, MO), an electronic medical record system that was utilized by all members of the patient's healthcare team which promoted interdisciplinary care. Patient-related instruction included education on PT evaluation and goals, bed mobility, bed positioning, plan of care, transfer training, and conservation of energy. Verbal, tactile, and visual cues were used as needed. The patient demonstrated barriers to learning that included her acuity of illness, cognitive deficits, and short-term memory loss. The patient required further teaching, practice, supervision, and needed reinforcement every session. The patient received eight out of eleven scheduled PT sessions prior to being discharged to IRU. Please refer to Table 6 for interventions and Figure 1 for illustrations.

Task-specific training was utilized with a focus on part-task practice for bed mobility, transfers, and ambulation. The purpose of each intervention was to restore the patient's independence through functional training. Since she was in the ICU, the parameters such as intensity, frequency, duration, and progression were dependent on her medical and mental status. Assessments and interventions were interchangeable each session through task analysis. Task analysis breaks down an activity into smaller components while tying in specific motor, perceptual, and cognitive abilities necessary to perform each component.[8] According to O'Sullivan,[9] restorative interventions are designed to promote and restore optimal functional capacity. Functional training task-oriented intervention uses normal patterns to accomplish tasks with motor learning strategies.[9] Part-task practice emphasizes practicing component parts prior to attempting the whole task with an emphasis on sequencing the steps in a correct order to successfully complete the task.[9]

During PT sessions, therapists were required to alter their plan of care depending on the patient's performance. Fortunately, with each non-consecutive session, she demonstrated improvement. As the patient progressed, the time it took her to complete tasks decreased, while her ability to withstand activities such as sitting and standing increased.

The patient was compliant during every PT session to the extent that her mental state would allow. PT sessions varied in duration and frequency, with the goal to see the patient six times per week. If she was unable to receive skilled PT services for any reason (e.g. lethargy, neurological changes, diagnostic imaging procedures), an acute care PT screen was written which provided a narrative as to why skilled PT services were not appropriate.

The rationale to focus on bed mobility, transfers, and gait/ambulation was to increase the patient's independence by reducing her burden of care. The goal was for her to be independent enough to manage three total hours of therapy in IRU. Bed mobility was essential to prevent skin

breakdown while having the patient practice transfers was important to reduce burden of care. Sitting and standing balance were initial stages prior to progressing to ambulation. While attempting to sit from supine, she suffered from severe dizziness and demonstrated ballistic movements in all planes of motion. Once she was able to tolerate sitting, she was progressed to standing. She demonstrated posterior loss of balance in standing that was hypothesized to be from the numerous days she remained supine in bed. According to Mulder et al.,[10] ten healthy subjects demonstrated postural instability and increased incidence of falls following only five days of bed rest. During the PT IE, verbal and tactile cues were not successful to counter the patient's retropulsion. Considering her background as a COTA, it was hypothesized that she may lean forward if a front wheeled walker (Roscoe Two-Button Folding Walker, CompassHealth, Middleburg Heights, Ohio) was placed in front of her as a visual cue. This theory was successful, and the patient grabbed the front wheeled walker (FWW) which also assisted the therapists when attempting to hold the patient upright.

Standing caused the patient to have uncontrolled bowel movements, therefore, a Certified Nursing Assistant (CNA) was always present in the room during PT intervention ready to assist. There were no other co-interventions. She quickly progressed from standing to ambulating. Upon discharge, the patient was able to ambulate twenty-five feet with moderate assistance of one person using a FWW. She successfully met all of her short-term goals and was discharged to IRU (see Table 5 for goals).

OUTCOME

The patient progressed from maximum assistance of two people to minimal assistance of one person by the end of her episode of care in the ICU (see Table 6). She demonstrated increased independence with bed mobility, transfers, sitting balance, standing balance, and

ambulation. The patient met all of her modified short-term goals after eight non-consecutive skilled PT sessions in the ICU (see Table 5). Task-oriented training along with verbal, visual, and tactile cuing had positive outcomes towards the patient's functional mobility progress. Her cognition and communication dramatically improved over the course of the PT sessions as evidenced by her ability to create full sentences and demonstrate improved command following.

The patient continued her medications and was deemed medically stable for discharge to an IRU. She did not meet any of her long-term goals in the ICU, but continued to work towards those goals in the IRU.

DISCUSSION

Throughout the patient's length of stay in the ICU, she demonstrated consistent improvement with her strength, cognition, problem solving, balance, and independence with all functional mobility. As supported by previous literature, the patient successfully increased her independence with functional mobility through task-oriented training. She progressed from maximum assistance of two people to minimal assistance of one person by the end of her episode of care in the ICU. She demonstrated increased independence with bed mobility, transfers, sitting balance, standing balance, and ambulation. With an interdisciplinary approach to her plan of care, the patient was able to be safely discharged from the ICU medically stable as well as functionally able to meet the demands of IRU.

The patient's rapid progress could potentially be attributed to the interdisciplinary approach where physicians and nursing ensured the patient was medically stable while the rehabilitation team ensured the patient continued to be challenged physically and mentally through task-oriented training. The focus was to increase the patient's activity as soon as possible, as research has documented that prolonged bedrest is attributed to deconditioning, postural instability, and gait abnormalities.[10] The patient demonstrated these impairments during the initial PT sessions,

but continually progressed over the course of her care.

There is limited research regarding PT in the ICU for patients diagnosed with encephalitis secondary to bacterial meningitis. Future research, although challenging as patients will present with their own individual limitations, is required with a focus on interventions and outcomes in order to ascertain a better PT prognosis. Future research should investigate: 1) the relationship of length of stay in the ICU; 2) how PT interventions are implemented; and 3) the likelihood of the patient's ability to return to their everyday activities post discharge from the hospital in order to help therapists establish a better PT prognosis.

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TABLES and FIGURES

TABLE 1. Inpatient Medications at Initial Evaluation

Active Inpatient Medications		
	Dosage	Administration
Adult Hypoglycemia Protocol	Adult (14 & Older)	IV
cefT RIAX one	2,000 mg = 50 mL	IV
Chlorhexidine topical	0.12%	Oral Swab
Doucsate-senna (Senokot S)	2 Tab	Oral
Heparin	5,000 units = 1 mL	Injection
levETIRAcetam (Keppra)	1,000 mg = 100 mL	IV
Sodium Chloride	2.5 mL	IV

IV = Intravenous, mg = milligram, mL = milliliter, Tab = Tablet

TABLE 2. System Review upon Initial Evaluation

Systems Review	
Cardiovascular/Pulmonary	**Impaired:** Arrhythmias and Respiratory Distress 4L/min Airgas Healthcare Nasal Cannula
Musculoskeletal	**Impaired:** Strength secondary to diagnosis
Neuromuscular	**Impaired:** Sitting Balance with loss of balance posteriorly
Integumentary	**Impaired:** Ventriculostomy scar (lateral surface of skull) healing well
Communication	**Impaired:** Delayed Processing
Affect, Cognition, Language, Learning Style	**Impaired:** Oriented x3: Person, Place, Time Calm, Cooperative, Perseverative, Short Attention Span Impaired Command Following Impaired Safety/Judgement Cognitive deficits included a 5 second attention span and 30 second response time

TABLE 3. Tests and Measures

Tests & Measures	Initial PT Evaluation Results
Glasgow Coma Scale score	15
Blood Pressure	110/65 (Semi-Fowler) 98/87 (Upright Sitting)
Gross LE ROM	WFL
Gross LE Strength	2/5
Gross UE ROM	WFL
Gross UE Strength	3+/5
Bed Mobility: **Rolling** **Scooting**	Moderate Assistance x2 Pt able to use of Guard Rails in Bed to assist Pt used triceps to assist with scooting
Supine <> Sit	Moderate Assistance x2
Sitting Balance	Impaired: Able to maintain balance without support for 2-3 seconds prior to LOB in all planes of motion

WFL = Within Functional Limits, Pt = Patient, LOB = Loss of Balance

TABLE 4.
Psychometric Properties of Glasgow Coma Scale Scores & Psychometric Properties[4]

Glasgow Coma Scale Scores		Psychometric Properties
3 – 8	Severe Brain Injury	Adequate: GCS inter-rater agreement = 71% Excellent: GCS agreement +/- 1 point = 90% Inter-rater agreement was similar for neurologist and ICU staff[4]
9 - 12	Moderate Brain Injury	
13 - 15	Mild Brain Injury	

3 = Deep Coma, 15 = Fully Awake Person

TABLE 5. Physical Therapy Short and Long-Term Goals

Short Term Goals: Initial Evaluation				
	Assist Level for Goal	Device for Goal	Time Frame to Reach Goal (days)	At Discharge
Bed Mobility	Minimal Assistance	None	7	Goal Modified
Transfers	Minimal Assistance	TBD	7	Goal Modified
Gait/Ambulation x25	Moderate Assistance	TBD	7	Goal Modified

Short Term Goals: Modified				
	Assist Level for Goal	Device for Goal	Time Frame to Reach Goal (days)	At Discharge
Bed Mobility	Minimal Assistance	None	10	Goal Met
Transfers	Supervision	None	10	Goal Met
Gait/Ambulation x25	Moderate Assistance	Front Wheeled Walker	10	Goal Met
Sitting Edge of Bed	Supervision 10 minutes	None	10	Goal Met
Standing	1 Person Moderate Assistance for 3 Minutes	None	10	Goal Met
Long Term Goals				
	Assist Level for Goal	Device for Goal	Time Frame to Reach Goal (days)	At Discharge
Bed Mobility	Independent	None	TBD	Goal Not Met
Transfers	None	None	TBD	Goal Not Met
Gait/Ambulation x150 feet	Goal Not Met	Least Restrictive Assistive Device	TBD	Goal Not Met

TABLE 6. Interventions

PT Treatment Sessions				
Intervention	**1 – 2**	**3 – 4**	**5 – 6**	**7 - 8**
Level of Assist **Bed Mobility Technique**	Max A x2 Part-task practice of log rolling, lowering LEs off EOB, and pushing up on UEs to upright sitting. Verbal and Tactile Cues to encourage AROM of LEs and UEs.	Mod-Max A x2 Part-task practice of log rolling, lowering LEs off EOB, and pushing up on UEs to upright sitting. Verbal and Tactile Cues to encourage AROM of LEs and UEs.	Min-Mod A x2 Part-task practice of log rolling, lowering LEs off EOB, and pushing up on UEs to upright sitting. Verbal and Tactile Cues to encourage AROM of LEs and UEs.	Min A x1 Verbal and tactile cuing for sequencing.
Level of Assist **Scooting Technique**	Max Ax2 Verbal cues to offload one hip at a time.	Mod-Max A x2 Verbal cues to offload one hip at a time.	Min-Mod A x2 Verbal cues to offload one hip at a time.	Min A Verbal cues to offload one hip at a time.

Level of Assist **Sitting Balance Technique**	Max Ax2 1 minute EOB Independent sitting 5x 10 seconds	Mod-Max x2 1 minute EOB Independent sitting for 5x 20-30 seconds with intermittent Min A	Intermittent Min A 5-10 minutes Dynamic Sitting Exercises: Reaching outside of base of support for a cup.	Independent 10 minutes. Dynamic Sitting Exercises: Reaching outside of base of support for a cup.
Level of Assist **Standing Balance Technique (Day 2)**	Max Ax3 3x 10-20 seconds Two therapists on each side of patient, while one therapist blocked knees from buckling.	Mod-Max Ax2-3 FWW for 3x 20-40 seconds	Mod Ax2 FWW for 3x 1 minute. Verbal cues to look up at TV in order to remain upright posture.	Mod Ax1 3 minutes with FWW. Verbal cues to name objects in the room on her R and L side.
Level of Assist **Transfer Technique**	Did Not Occur	Mod-Max Ax2 FWW and verbal cues for sequencing	Mod-Min A FWW and verbal cues for sequencing	Supervision FWW and verbal cuing for sequencing
Level of Assist **Gait Training Technique (Day 2)**	Max A x2 Ambulation 4 feet A/P and M/L with FWW. Frequent verbal and tactile cuing	Mod-Max Ax2 Ambulation 4-10 feet A/P and M/L with FWW. Verbal and tactile cuing	Mod-Max Ax2 Ambulation 15-20 feet with FWW. Verbal and tactile cuing	Mod A x1 Ambulation 25 feet with FWW. Verbal and tactile cuing
Patient/Family Education	Bed Mobility; Bed positioning, Physical Therapy Evaluation and Goals, Physical Therapy Plan of Care, Transfer Training, Conservation of Energy.			

LE = Lower Extremity, UE = Upper Extremity, EOB = Edge of Bed, AROM = Active Range of Motion, Max A = Maximum Assistance, Mod A = Moderate Assistance, Min A = Minimum Assistance, FWW = Front Wheeled Walker, A/P = Anterior / Posterior, M/L = Medial / Lateral

APPENDICES

Appendix 1.

(**A**) ICU Room, (**B**) Hospital Bed Controls (Hill-Rom, Chicago, IL), (**C**) NDS LifeVue™ Monitoring Display (Ampronix, Irvine, CA)

A. 

B. 

C.