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Early Physiotherapy Interventions for Severe Traumatic Brian Injury with Subsequent Stroke Right Side Weakness

Theeb Naif S Alsalem*

[1]Physiotherapist, King Abdulaziz Medical City, National Guard Health Affairs, Riyadh, Saudi Arabia; Studying Master of Health Administration at Saudi Electronic University, Riyadh, Saudi Arabia.

***Corresponding author**: Theeb Naif S Alsalem, King Abdulaziz Medical City, National Guard Health Affairs, Riyadh, Saudi Arabia; Studying Master of Health Administration at Saudi Electronic University, Riyadh, Saudi Arabia.

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Abstract

Background & Purpose: Recovery after severe traumatic brain injury (TBI) often involves prolonged immobility, resulting in decreased balance, strength, and endurance, and increasing the risk of secondary complications such as wounds, contractures, and respiratory illnesses. The purpose of this case report is to describe the sudden progress from acute course toward a sub-acute and chronic phase of rehabilitation of a patient with a severe TBI with subsequent stroke right-side weakness and emphasize the role of physical therapy in preparing the patient for the next level of care.

Case Description: Sixteen-year-old male on 10 August 2019 post-motor vehicle crash after a front seated and ejected from the car admitted at a local hospital where poor acute management no physiotherapy was addressed to the patient which resulted in a severe traumatic brain injury.

transfers to an advanced hospital on 18 Aug 2019 where he had a prolonged hospitalization complicated by ventilator-associated pneumonia and respiratory failure and physiotherapy from day 1. Physical therapy interventions during the acute toward chronic hospitalization included positioning, bed mobility, range of motion, transfers, balance, and gait training.

Outcomes: The patient was treated daily for 4 months during his hospital stay he had once weekly until reach the sub acute phase patient get accepted for an intensive physiotherapy program from 24 Sep 2019 where he got two sessions of physiotherapy with a measurements scale were placed such as Functional Independence Measure 'FIM', Modified Ashworth Scale 'MAS' and Manual Muscle Test 'MMT'.

Discussion: Physical therapists using FIM, MAS, and MMT play an integral role in the sub acute recovery of severe TBIs to improve functional mobility and prevent secondary complications associated with prolonged immobility. This case demonstrates the importance of early mobilization with the use of common functional assessment and measurement tools at all treatment phases that the patient went through and how progression applied.

Conclusion: Researchers do agree that the most practical treatment approach is one that is multidisciplinary and goal-oriented, with early and often involvement of all members of the healthcare team, along with family education and commitment. More research is highly needed to expose the effectiveness of specific physical therapy interventions to facilitate motor recovery and ultimately functional recovery in the traumatic brain injury community.

Keywords

Rehabilitation care; Physiatry; Physiotherapy; Rehabilitation; Traumatic brain injury; Stroke

Abbreviations

MMT: Manual Muscle Testing; FIM: functional independence measure; MAS: Modified Ashworth Scale; TBI: Traumatic Brain Injury

Introduction

The public health concern of traumatic brain injuries is consequentialabout153 people in the U.S. die each day from injuries that include TBI, costing a calculated $76.5 billion each year [1]. In 2013, these injuries lead to 2.5 million emergency department visits and 282,000 hospitalizations [1]. The Glasgow

Coma scale authorized classification of traumatic brain injury as mild, moderate, or severe and is need as soon as possible after the injury, and at variable times thereafter. Scores 3-8 are segregated as severe TBI, 9-12 as moderate TBI, and 13-15 as mild TBI [2]. Severe TBI demands aggressive management and often results in cognitive and physical manifestations that force long-term disability. It is calculated that 5 million people in the United States are affected by long-term disability after TBI [3]. Severe injury provokes not only long-lasting neurological deficits (20% of adults) but it has been exposed that 20%-40% of patients end up dying as a consequence of brain injury or secondary complications [4]. Other studies declared mortality rates as high as 76% to 89% [4]. Traumatic brain injuries result in a myriad of clinical demonstrations due to both neural damage and other concurrent injuries such as orthopedic fractures, integumentary wounds, and/or vascular damage, in addition to secondary conditions that form post-injury. Clinicians should prepare for deficits in arousal, attention, cognition, cardio-respiratory function and endurance, joint integrity, motor function, and functional mobility [5].

Physical therapy is an authorized and common feature of recovery after TBI given the lengthened bed rest and deep sedation often involved. In the acute inpatient phase of care, the aim is to reform motor and functional recovery while limit or treating secondary complications by reassuring movement and upright posture or sequelae such as neuromuscular weakness, reduced aerobic capacity, and persistent participation restrictions often observe a stay in the ICU [6].

In this case report, early functional mobility training was proposed based on well-documented evidence to aid its validity in improving patient outcomes. Physical Therapists who are specialist in the critical care unit 'ICU' work to progress the quality of life, physical function, peripheral and respiratory muscle strength, escalating ventilator-free days, and reducing hospital and ICU stay [7]. As per the Evidence-Based Review of Acquired Brain Injury project, there is Level 2 evidence to assist that early rehabilitation is coming together with better outcomes such as lengths of stay and shorter comas, better Functional Independence Measure 'FIM' scores, tremendous cognitive levels at discharge, and a greater likelihood of discharge to home [8]. Interventions are marked at minimizing joint stiffness, muscle shortening, and sensory deprivation, facilitating balance, and add to the quality of movement [9]. Hellweg et al. figured out that functional training directly results in enhanced sit-to-stand transfers, upper extremity use, and gait [10]. Animal models prove that early training (freedom to move) and an embellished environment (the presence of others) improves functional recovery. Motor skills training shall build up adaptive similar reestablishment mechanism or neural plasticity that could contribute to rebuilding or recall of function [11]. Post brain injury, the sensorimotor action of the victim constructs this neural remodeling, by offering that physiotherapeutic interventions provoke the neuroplastic potential of the human brain [12].

In acute hospitalization, early transitioning from supine to sitting is emboldened, emerge in improvements in functional residual capacity and more regular ventilation and perfusion. Besides, gravity aids in the mobilization of mucus within the lungs [13]. Further positional changes by standing brain-injured patients who were vegetative or minimally conscious revealed significant improvement in arousal and/or awareness. Positioning every two hours have also been shown to rule out hypovolemia, alter resting muscle length, load vertebrae, redistribute skin pressure, aid the respiratory system, reduce

osteoporosis, improve circulation, and aid renal function [14].

Despite an imperfect level of consciousness, the inception of physical therapy as soon as medically appropriate may drive to enhanced outcomes. Edlow et al. [13] found that MRI and EEG can identify covert consciousness and cortical feedback in patients who lack behavioral evidence of consciousness, giving evidence that patients may recover consciousness before behavioral hints are present. Lack of a reliable clinical tool to identify consciousness delays and limits approaches to rehabilitative care [15]. In this case, the early inception of physical therapy despite impaired communication was important to maximize the patients' rehabilitation potential.

Widespread use of outcome measures such as the FIM scale generates an easy to use and readily available tool for clinicians to audit patients' functional status. It relies on the reliable measurement and determination of the level of assistance appropriate to complete a mobility task, skilled both physical therapists and nursing staff are qualified to do plus caregivers of the patient such as patient family. The purpose of this case report is to describe the acute rehabilitation course of a patient with a severe TBI with right side weakness stroke and point out the role of physical therapy interventions, notably functional mobility training, in preparing the patient for the next level of care and in preventing secondary complications combined with immobility. Functional mobility training formulates the patient for the next level of care and in preventing secondary complications associated with immobility.

This patient case was picked due to the unique challenges of patients suffering from sequelae of complications combined with severe traumatic brain injuries, including impairments of orientation, difficulty in communication, and the absence of similar cases reported in the literature. Besides, the cultural situation described here reveals social conflicts to consider when running a patient care plan.

Case History

The patient was a 16-year-old male who had a motor vehicle crash. He presented to a local hospital in Saudi Arabia with eye laceration, hypotension, and acute respiratory failure. CT scans severe head injury with Small left internal carotid dissection and subsequent stroke present right-side weakness.
Initial medical intervention ensured the stabilization of all vital functions. His Glasgow Coma Scale score was 3 at initial presentation, indicating severe TBI free medical and surgical history as per his family. He was a student at an elementary school.

Examination

The initial evaluation by the physical therapist. Neurosurgery physicians ordered that precautions be followed which were patient needs to be contact isolation due to infection, right 'Ankle-Foot Orthosis' and right arm sling. Patient problems he was not able to ambulate, need helper during bed mobility, need two helpers during standing, and could not do stairs climb. The therapist was unable to assess an active range of motions or Manual muscle testing (MMT) at the right side, but the passive range of motions was limited by spasticity in both upper and lower limbs. Spasticity was noted in Right hip adductors, knee flexors, and plantar flexors in lower limbs 2/4 on MAS "Modified Ashworth Scale".

While in upper limbs shoulder adductors, elbow flexors and wrist flexors severe spasticity 4/4 on MAS. MMT was done on the left side shown a powerful left side with no weakness found and so what the physical therapist could not assess was patient aphasic which made the patient got sessions with a speech therapist who explained that patient can have input and output in verbal cue affected.

Short Term Goals	Long Term Goals
Log rolling= supervision	transfer skills=complete independent
supine-> sit =supervision	mobility skills=hemi-walker, Right dynamic AFO
sit -> stand =Minimal assistance	assistive devices= hemi-walker, Right dynamic AFO, Right arm sling, Right wrist support
Bed to chair = Moderate assistance x1person	ambulation =reach 400ft no supervision with walking aid

Table 1: Short-term and Long-term goals.

Plan of Care

The treatment plan consisted of functional training, gait training, monitored mobility, verticalization in tilting table, proprioceptive neuromuscular facilitation, weight shifting, and therapeutic exercise with physical therapy treatment sessions occurring daily. The period of the inpatient intensive rehabilitation program took 16 weeks (Table 1).

Interventions

Therapy sessions were two sessions daily 9 am, 3 pm 5 days per week for 16 weeks.It was vital to make thorough observations of the patient during each session. Due to the patient's difficulty explaining his ability to reveal pain vital signs were monitored during treatment as possible indications of pain. Functional Independence Measure"FIM" was the main tool for outcome measurement for impairment and physical disability. Observation of posture was a responsibility of the therapist, as an indication of pain, autonomic function, or neurological syndromes. Other symptoms noted combined episodes of tachycardia, hypertension, diaphoresis, and dystonia, all of which are expected with sympathetic hyperactivity [5,16].

Weeks 1-3

The first weeks of physical therapy treatment sessions at the inpatient rehabilitation program focused on the prevention of neurological and integumentary complications. Treatment consisted of

positioning with pillows and other devices to offload bony prominences including the calcaneus, greater trochanter, ischial tuberosity, sacrum, occiput, and olecranon, along with turning every 2 hours. Passive range of motion was performed for family education so during the day and night can allow a spontaneous and free motor activity to shoulder, elbow, and wrist on the right side. Resting night splint and the blue boot was used to prevent plantar flexion contractures plus an air mattress was used to decrease the risk of pressure sores. The second major intervention included positional changes to improve tolerance to upright sitting. Bed mobility out of bed and in bed.

Later supine to sit transfers training started, along with sitting balance were repeated and point out clearly. Tactile and verbal cues were employed to educate the patient on proper upright sitting technique. The supine to sitting transfer was performed with minimal assistance during the first three weeks. The patient's tolerance to sitting at the edge of the bed was monitored closely with vital signs, verbal indicators of pain, and amount of assistance provided. He progressed from an initial 10 minutes of sitting tolerance to 15 minutes after two weeks. The level of assistance provided improved from minimal assistance to moderate assistance for sitting balance. After the patient demonstrated tolerance to upright sitting with stable vital signs, the Nursing staff was advised to do minimal assistance so the patient can progress and tolerate further in "chair position" three times/day.

Week 4-12

The next phase of treatment in the inpatient intensive rehabilitation program started and focused on the facilitation of standing tolerance and gait. The patient reached sit to stand transfer training with maximal assistance of two persons which improved to moderate assistance of two persons. The therapists assisted by closing the patients' knees and providing a forward weight shift and trunk lift while giving tactile cues for extension through the thoracic and lumbar spine. The patient was found to demonstrate failed weight shifting, impaired force production direction, impaired control of descent, insufficient active weight-bearing in bilateral lower extremities, and shifted center of mass posteriorly resisting correction.

The sitting balance was also improved with the patient tolerating and requiring minimal assistance to maintain balance. Dynamic sitting balance improved to requiring supervision intermittently due to the patient's impaired midline awareness.

Week 13-15

The patient starts to take his first steps during this last phase after the physical therapist provided the right dynamic AFO and right arm sling. The administration of Botox injection by physiatry was done for flexors synergies and adductors at upper limbs plus Baclofen 10 mg later changed to dantrolene 10mg for general right-side spasticity Firstly, he needed minimal assistance of two persons for large weight shifts and forward progression of swing leg later on assistance was not needed only supervision and verbal cues. The therapists used their leg and foot to advance the swing limb forward while also facilitating a weight shift towards the stance limb and closing the knee of the stance limb finally patient re-learn and get familiar with the new type of gait. The patients also re-learn tactile cueing at one shoulder to facilitate trunk extension. Finally, was able to tolerate 12 meters of this gait before he

started to become fatigued and could not hold any of his body weight.

By the 13th week, the speech-language pathologist completed a counting activity when the patient mouthed three numbers across multiple trials. He completed sit to stand transfers with moderate assistance from two persons. He increased his gait distance to 20 meters using Hemi-walker with supervision and assistance for weight shifts. His gait distance was limited by fatigue. During the 14th week, the patient achieved a gait distance of 300 meters but continued to require using hemi-walker but not further assistance at weight-bearing. By the end of the 15th week, he was able to complete 400 meters using Hemi-walker without supervision.

Week 16

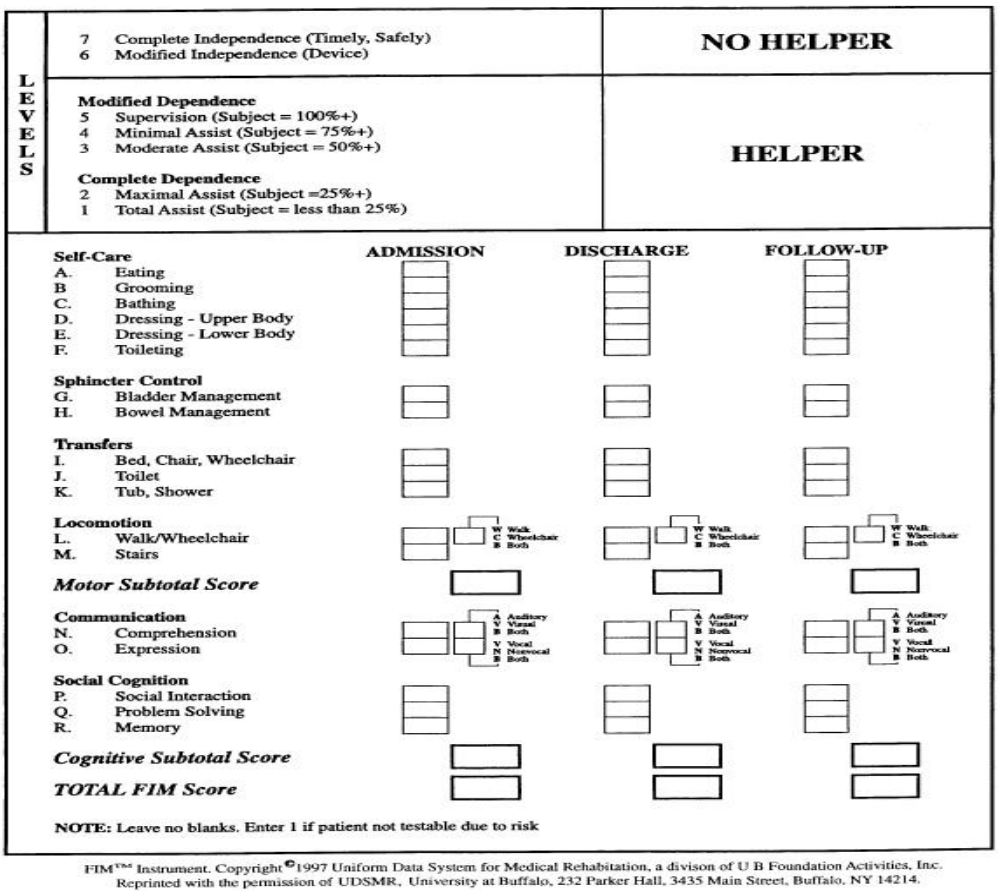
This was the final week of the patient's inpatient hospitalization before being discharged to outpatient rehabilitation in the same hospital. He completed bed mobility and supine to sitting transfers without assistance complete independent also complete independent stood. He did progress gait distance. He was able to use a Hemi walker for ambulation this week and reach 450 meters. The patient demonstrated the ability to initiate stepping without any cues for the progression of the swing leg this week. Table 2 below shows the patient's progress, requiring less assistance over time.

Period	Bed mobility	Supine->Sit	Sit->Stand	Gait
Week 1-3	Minimal assistance	Maximum assistance	Did not attempt	Did not attempt
Week 4-12	Minimal assistance	Moderate assistance	Max Ax2	Did not attempt
Week 13-15	Complete independent	Complete independent	Complete independent	By hemi walker 400 meters supervision
Week 16	Complete independent	Complete independent	Complete independent	By hemi walker 450 meters supervision

Table 2: Required assistance for mobility tasks.

The patient initially scored the lowest possible at FIM 'Functional Independence Measure'. At the first acute rehabilitation but he was progressed furthermore after each week. Table 1 & Table 2 explain the goals and progression that was made and done for the patient during his stay at the hospital Appendix 1.

FIM™ instrument



Appendix 1: FIM instrument.

Discussion

The huge sudden improvements in performance and the advanced time have taken on assistance for mobility tasks made this patient case did not credit the effectiveness of physical therapy interventions only but a whole interdisciplinary team made such an effective treatment for patient and family awareness possible. Clinicians must acknowledge the effectiveness of PT intervention in the prevention of secondary complications that could have had life-threatening events. Besides, the effects of intervention may not demonstrate measurable improvements in mobility, but rather serve as neural priming for the long-term rehabilitation of motor function. Clinicians should manage treatment by the fundamental goal of neurological rehabilitation, which is to navigate neural reorganization in a manner that facilitates recovery of function.

This case report expressed acute physical therapy interventions in the treatment of an adult with a severe traumatic brain injury and secondary complication resulted in Right side stroke weakness. The outcomes brought out to demonstrate significant improvement in functional ability, however, the

presence of secondary complications correlated with immobility and the progression of mobility with decreasing levels of assistance demonstrate the effectiveness of the physical therapy interventions. At hospital discharge, the patient was ready to transition to outpatient rehabilitation, where he would receive more maintained and specific therapy interventions and make significant improvements in functional mobility. This patient case serves as an addition to the closed research evidence available for physical therapy treatment of severe TBI with stroke complication and adds to the priority of physical therapy for these patients in the acute rehabilitation care setting. Despite the common and familiar use of physical therapy for patients following TBI, there remains only a small amount of evidence to support its effectiveness in developing patient outcomes in this particular population. Studies have marked significantly improved functional mobility outcomes as well as the shortened length of stay and cost of care in neuro/trauma patients participating in a framed mobility program in the ICU [8]. A systematic review of physiotherapy after TBI concluded (2008) "powerful evidence exists that intensive task-orientated rehabilitation programs lead to earlier and well functional abilities'' [9]. Researchers do agree that the most practical treatment approach is one that is multidisciplinary and goal-oriented, with early and often involvement of all members of the healthcare team, along with family education and commitment. More research is highly needed to expose the effectiveness of specific physical therapy interventions to facilitate motor recovery and ultimately functional recovery in the traumatic brain injury community.

Conclusion

This case report expressed acute physical therapy interventions in the treatment of an adult with a severe traumatic brain injury and secondary complication resulted in Right side stroke weakness. The outcomes brought out to demonstrate significant improvement in functional ability, however, the presence of secondary complications correlated with immobility and the progression of mobility with decreasing levels of assistance demonstrate the effectiveness of the physical therapy interventions. Researchers do agree that the most practical treatment approach is one that is multidisciplinary and goal-oriented, with early and often involvement of all members of the healthcare team, along with family education and commitment. More research is highly needed to expose the effectiveness of specific physical therapy interventions to facilitate motor recovery and ultimately functional recovery in the traumatic brain injury community.

References

1. Taylor CA, Bell JM, Breiding MJ, Xu L. (2017) Traumatic Brain Injury Related Emergency Department Visits, Hospitalizations, and Deaths-United States, MMWR. Surveill Summ. 66(9):1-16.
2. Teasdale G, Jennett B. (1974) Assessment of coma and impaired consciousness: a practical scale. The Lancet. 2(7872):81-84.
3. https://www.uptodate.com/contents/traumatic-brain-injury-epidemiology-classification-and-pathophysiology
4. Steppacher I, Kaps M, Kissler J. (2016) Against the odds: a case study of recovery from coma after devastating prognosis. Ann Clinic Transl Neurol. 3(1):61-65.
5. O'Sullivan SB, Schmitz TJ, Fulk GD, eds. (2014) Physical Rehabilitation. 6th ed. Philadelphia, PA: FA Davis. 859-81.

6. Ohtake P, Smith J, Chong Lee A, Scott JC. (2016) Early rehabilitation for patients in the intensive care unit (ICU). APTA Clinical Summaries.
7. Kayambu G, Boots R, Paratz J. (2013) Physical Therapy for the Critically Ill in the ICU: A Systematic Review and Meta-Analysis. Critic Care Med. 41(6):1543-54.
8. Teasell R, Marshall, Shawn, et al. (2013) Evidence-based review of moderate to severe acquired brain injury: executive summary.
9. Tolfts, Annabel & Stiller, Kathy. (1997) Do patients with traumatic brain injury benefit from physiotherapy? A review of the evidence. Physiotherapy Theory Pract. 13(3):197-206.
10. Hellweg S, Johannes S.(2008) Physiotherapy after traumatic brain injury: a systematic review of the literature. Brain Injury. 22(5):365-373.
11. Mazaux JM, De Seze M, Joseph PA, Barat M. (2001) Early rehabilitation after severe brain injury: a french perspective. J Rehab Medicine. 33:99-109.
12. Nudo RJ. (2003) Adaptive plasticity in motor cortex: implications for rehabilitation after brain injury. J Rehab Med. 41:7-10.
13. Edlow BL, Chatelle C, Spencer CA, Chu CJ, Bodien YG, O'Connor KL, et al. (2007) Early detection of consciousness in patients with acue severe traumatic brain injury. Brain. 140(9):2399-2414
14. Gillick BT, Marshall WJ, Rheault W, Stoecker J. (2011) Mobility criteria for upright sitting with patients in the neuro/trauma intensive care unit: an analysis of length of stay and functional outcomes. The Neurohospitalist. 1(4):172-7.
15. Coleman MR. (2005) The assessment and rehabilitation of vegetative and minimally conscious patients. Neuropsychological Rehab. 15(3/4):161-2.
16. Hannawi Y, Abers MS, Geocadin RG, Mirski MA. (2016) Abnormal movements in critical care patients with brain injury: a diagnostic approach. Critic Care. 20:60.