Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(6), 1156-1163 | ISSN:2251-6727

Early Physiotherapy Improves Consciousness Level in Severe Traumatic Brain Injury Patient

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(Received: 07 October 2023 Revised: 12 November Accepted: 06 December)

KEYWORDS

Traumatic Brain Injury, Early Physiotherapy, Consciousness Levels, Glasgow Coma Scale, Rehabilitation Effects

ABSTRACT:

Background: Traumatic Brain Injury involves brain damage from impact,Mild, moderate, and severe.Severity are assessed using the "Glasgow Coma Scale (GCS)". Severe Traumatic Brain Injury affects cognition, emotions, and physical health, increasing neurodegenerative risk.Assessment of consciousness level is crucial for prognosis and treatment. Functionality and quality of life are improved by rehabilitation.Evidence suggests that physiotherapy improves traumatic brain injury patients' consciousness.

Aims and objectives: The objective of this study is to examine the effects of early physiotherapy intervention on the enhancement of consciousness levels among individuals diagnosed with severe traumatic brain injury.

Method: This retrospective study enrolled 56 severe "Traumatic Brain Injury (TBI)" patients from the emergency department.Divided into experimental groups and control groups,the experimental group received physiotherapy management for 14 days.Inclusion criteria included proper assessment and consent, while exclusion criteria involved treatment transfer, lack of consent, inability to undergo physiotherapy, Non- Traumatic brain injury injuries, and insufficient records or follow-up.

Result: The study compared two groups, one receiving early physiotherapy and the other serving as a control groups.Analysis showed no significant differences in diagnosis or gender distribution. However, significant distinctions emerged in age and the change in "Glasgow Coma Scale (GCS)". Early physiotherapy significantly impacted Glasgow Coma Scale improvement. The diagnostic breakdown highlighted varied prevalence rates, emphasizing the need for individualized therapies based on specific traumatic Brain Injury diagnoses.

Conclusion: The study has evidently shown that the Glasgow Coma Scale increases significantly by providing effective physiotherapy in patients with severe Traumatic Brain Injury.

1. Introduction

"Traumatic brain injury (TBI)" pertains to the harm or disturbance inflicted upon the brain due to a traumatic incident, such as a forceful impact on the cranium or a penetrating wound. Traumatic brain injury can lead to a diverse collection of physical, cognitive, emotional, and behavioural manifestations. The classification of TBIs enclose mild, moderate, or severe categories,dependent on the extent of the injury and its implications for the individual's clinical condition. Among these, mild Traumatic brain injury, informally referred to as a concussion, stands as the most prevalent form of Traumatic brain injury and is characterised by transient dysfunction of the brain [1,2].

"Traumatic brain injury (TBI)" is classified by severity using the "Glasgow Coma Scale (GCS)", which rates eye-opening response, verbal response, and motor response, with scores ranging from 3 to 15.Categories include Mild TBI (GCS 13-15) like concussions; Moderate TBI (GCS 9-12) involving extended unconsciousness or amnesia with notable cognitive and functional impairment; and Severe TBI (GCS 3-8), representing the most critical cases with prolonged unconsciousness, substantial neurological deficits, and elevated mortality risk [3]. It's crucial to emphasize that

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JCHR (2023) 13(6), 1156-1163 | ISSN:2251-6727

the assessment of TBI severity extends beyond the GCS score as a singular determinant. The comprehensive evaluation of severity and prognosis considers a range of other elements, including imaging results, clinical manifestations, and concomitant injuries, all of which collectively contribute to the holistic assessment [3,4].

The worldwide occurrence of “Traumatic brain injury (TBI)” is believed to be substantial. As per a methodical examination and meta-analysis, the consolidated yearly occurrence proportion of traumatic brain injury for all age groups stands at 295 per 100,000 individuals, while the aggregated incidence rate is 349 per 100,000 person-years. the prevalence of traumatic brain injury exhibits considerable variations dependent on factors such as age, gender, and geographical location [5].

Severe“traumatic brain injury (TBI)” has profound consequences, impacting cognition, emotions, social interactions, and physical well-being. Cognitive challenges involve attention, memory, problem-solving, and decision-making. Emotional and behavioral changes include personality shifts, irritability, mood disorders, and apathy. Social and interpersonal dimensions are disrupted, affecting empathy and relationships. Physical impairments encompass motor deficits, coordination issues, and sensory problems. Moreover, severe TBI elevates the risk of developing neurodegenerative conditions like dementia, “chronic traumatic encephalopathy”,and Alzheimer's disease [6-10]

Consciousness level is a pivotal factor in “traumatic brain injury (TBI)”, providing critical insights into its severity and guiding treatment strategies. Research has revealed a connection between autonomic reactivity, such as heart rate variability and skin conductance, and the recovery of consciousness in severe TBI's post-acute phase. Even in persistent disorders of consciousness, the potential for recovery exists during rehabilitation. Accurate consciousness assessment is crucial, impacting prognosis, treatment choices, and functional outcome predictions in TBI. Established tools like the “Glasgow Coma Scale (GCS)” offer objective measure to assess consciousness in traumatic brain injury patients, aiding in clinical decisions [11-14].

A range of rehabilitation options exists for “traumatic brain injury (TBI)” recovery, all aiming to enhance function, independence, and overall quality of life. Acute rehabilitation programs provide early, multidisciplinary intervention in physical, cognitive, and social retraining.Cognitive rehabilitation targets cognitive skills like attention and memory with customized techniques.Vocational rehabilitation supports traumatic brain injury individuals in returning to work through training and job support.Community-based rehabilitation aids reintegration into daily life, including home visits and community programs.Virtual reality rehabilitation offers innovative and immersive cognitive tools for traumatic brain injury recovery[15-19].

Physiotherapy, a healthcare discipline, employs physical techniques like exercise, manual therapy, and electrotherapy to facilitate healing, alleviate pain, and enhance physical capabilities. Its applications are frequently seen in addressing musculoskeletal issues such as back pain, joint injuries, and sports-related injuries. Ultimately, the primary goal of physiotherapy is to restore peak physical function, reduce discomfort, and enhance overall quality of life [20]. Emerging evidence indicates that early physiotherapy interventions can positively influence consciousness levels in “traumatic brain injury (TBI)” patients. Proactive, early mobilization strategies, including physiotherapy, led to enhancements in consciousness, cognitive functions, motor skills, and communication abilities in a patient diagnosed with TBI in a “Minimally Conscious State (MCS)” [21].

1. Methods

Research Design

This is a retrospective study which has enrolled patients of severe traumatic brain injury from the hospital who visited the emergency department of Teerthanker Mahaveer hospital & Research Center, Moradabad between February 2023 to September 2023. The patients were determined for “Glasgow Coma Scale (GCS)”. The study obtained 56 traumatic brain injury patients and divided them into 2 groups. First group was the Experimental group which received physiotherapy for 14 days. The patients were followed-up after 14 days and again, they were determined for Glasgow Coma Scale.

Inclusion and Exclusion Criteria

Inclusion

- Patients hospitalised at Teerthanker Mahaveer hospital & Research Center, Moradabad with severe traumatic brain injury.
- Patients with TBI whose GCS 3 to 8 and other required parameters were assessed properly.
- Patients who were given physiotherapy during the first 2 weeks.

Exclusion

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- TBI patients who got transferred to another facility in the middle of the treatment
- Patients who did not give consent
- Patients who could not undergo physiotherapy
- Patients without enough required records or the follow-up was not done properly.

Statistical Analysis

The study has used SPSS 25 for effective analysis ,employed ANOVA for finding out the relationship between the early physiotherapy with that of Glasgow Coma Scale status. The continuous data was expressed as mean±standard deviation while the discrete data was expressed as frequency and percentage. The graphs were plotted using MS Excel.

Ethical approval

The patients' permission has been obtained.The ethics board has given its clearance of approval to the study's

2. Results

Figure 1 shows that the study included 33 male and 23 female participants. This percentage of males to females shows that men are overrepresented in the sample population. The data implies a potential gender imbalance, which could be a factor impacting the study's findings. Given the potential for differences in health outcomes or reactions to interventions between males and females, researchers should be sensitive to gender-related variations in their analysis and interpretation of results. In order to draw valid and complete conclusions from the study's findings, it is crucial to recognize and address gender inequalities.

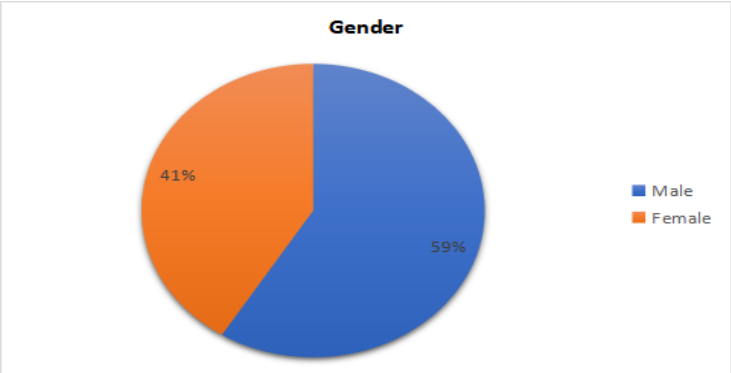

Figure 1: Male and Female proportion in the study

The study's diagnostic breakdown reveals a wide range of disease prevalence rates. There appears to be a high frequency, as 18 people have been diagnosed with intracerebral hemorrhage and 18 with injuries sustained in a car accident. The next most common diagnosis is subdural hematoma with 13 instances, while the least common is diffuse axonal injury with only 7. A more accurate representation of the proportional distribution of these diagnoses would be shown in Figure 2, which represents the percentages of patients in the entire research. The findings illustrate the necessity of examining the various nature of traumatic injuries within the research population, potentially altering treatment approaches and stressing the need for individualized therapies depending on the specific diagnosis.

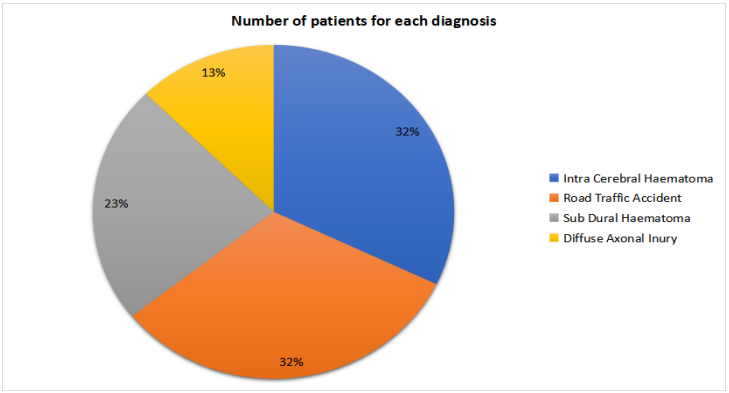

Figure 2: Percentages of patients in the whole study

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In a study with 28 participants in each group, the baseline characteristics of the experimental and control groups were compared. Compared to the control group's average age of 42.923.65 (the experimental group's average age was 38.397.45). There were 63.57 % males and 46.42 % females in the test group, and 64.28 % males and 35.71 % females in the control group. Differences in diagnoses were found between the two groups, with RTAs being more common in the experimental group (42.85% vs. 21.42%). In addition, there were notable variations between the groups in terms of the mean "Glasgow Coma Scale (GCS)" on Days 1 and 14, as well as the mean change in GCS, indicating potential differences in patient outcomes.

Table 1: Findings of the baseline characteristics of the patients in each group

Parameter	**Experimental group n=28**	**Control group n=28**
Age	38.39±7.45	42.92±3.65
Sex		
Male	15 (53.57%)	18 (64.28%)
Female	13 (46.42%)	10 (35.71%)
Diagnosis		
Intra Cerebral Haematoma	8 (28.57%)	10 (35.71%)
Road Traffic Accident	12 (42.85%)	6 (21.42%)
Sub Dural Haematoma	4 (14.28%)	9 (32.14%)
Diffuse Axonal Injury	4 (14.28%)	3 (10.71%)
GCS		
Mean GCS at Day 1	6.21±0.91	6.92±0.76
Mean GCS at Day 14	11.67±1.41	8.78±1.19
Mean Change in GCS	5.46±1.47	1.85±0.84

The table presents the results of significance tests comparing two groups: the experimental group, which received early physiotherapy, and the control group, which did not receive early physiotherapy. Both groups consisted of patients with severe "Traumatic Brain Injury (TBI)". Four parameters were examined: Diagnosis, Age, Gender, and Change in "Glasgow Coma Scale (GCS)". In terms of Diagnosis, the analysis yielded a F-value of 1.392 with a corresponding p-value of 0.243. This p-value is greater than the conventional threshold of 0.05, indicating that there is no statistically significant difference in diagnosis between the experimental and control groups. Age, on the other hand, showed a notable distinction between the groups. The F-value was 8.609, and the associated p-value was 0.005, which falls below the 0.05 threshold for statistical significance. This indicates a significant difference in age distribution between the experimental and control groups. The parameter of Gender revealed a F-value of 0.648 with a p-value of 0.424. With a p-value exceeding 0.05, the analysis suggests no statistically significant difference in gender distribution between the two groups. The most striking finding emerged in the analysis of Change in "Glasgow Coma Scale (GCS)". Here, the F-value was 125.47, and the reported p-value was less than 0.001, signifying an extremely small p-value that is below the conventional significance level of 0.05. This indicates a highly

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statistically significant difference in the change in GCS between the experimental and control groups. In summary, the results highlight a significant disparity in Age and Change in GCS between the experimental and control groups, indicating that early physiotherapy had a substantial impact on the improvement in Glasgow Coma Scale. However, there were no statistically significant differences observed in Diagnosis or Gender distribution between the two groups.

Table 2: Findings of the Significance tests with respect to the group (Experimental or Control)

Parameter	F-value	Significance (P-value)
Diagnosis	1.392	0.243
Age	8.609	0.005
Gender	0.648	0.424
Change in GCS	125.47	<0.001

4. Discussion

Physiotherapy is pivotal in the rehabilitation of "traumatic brain injury (TBI)" patients, aiming to enhance physical function, mobility, and overall well-being. It involves exercises to sustain strength, balance, coordination, and gait, alongside methods to address spasticity and enhance range of motion. Studies declare that intensive rehabilitation regimens contribute to earlier and improved functional capabilities for individuals recovering from TBI [22-24]. Physiotherapy in "traumatic brain injury (TBI)" patients aims to enhance function, accelerate recovery, prevent complications, and improve overall quality of life. It addresses mobility, balance, coordination, strength, and endurance challenges. Goals include improving gait, balance, muscle strength, flexibility, coordination, and daily task independence. Physiotherapy also manages pain, reduces spasticity, and corrects posture and coordination issues, ultimately optimizing physical function and helping individuals achieve their functional objectives [25-28]. Physiotherapy plays a crucial role in addressing cognitive impairments in traumatic brain injury (TBI). Physiotherapists assess functional status using tools like the Functional Independence Measure and Glasgow Coma Scale, then develop tailored treatment plans for cognitive deficits. Interventions include cognitive rehabilitation exercises, balance and coordination training, and dual-task exercises that combine cognitive and motor challenges. These strategies aim to improve attention, memory, executive function, and overall cognitive and psychosocial well-being for TBI patients [29,30]. Initiating physiotherapy early in "traumatic brain injury (TBI)" is widely recommended to expedite recovery and minimize complications. Laccarino et al.'s comprehensive review (2016) emphasizes the favorable impact of early mobilization and rehabilitation, including physiotherapy, on TBI patient outcomes. Early mobilization helps prevent issues like muscle weakness and contractures, promoting neuroplasticity and functional recovery. Nonetheless, the timing and intensity of physiotherapy should be personalized based on the patient's condition and medical team assessment [31] Elkbuli et al.'s recent study (2022) involving 11,937 patients highlighted the benefits of early initiation of physical therapy (PT) and mobilization for trauma patients, including those with "traumatic brain injury (TBI)". Among non-TBI patients, delayed PT commencement was associated with a 60% reduction in the likelihood of being discharged home without additional services, prolonged hospital and ICU stays, and a higher risk of complications. In contrast, TBI patients with delayed PT initiation had a 76% lower chance of being discharged home without extra services and longer hospital and ICU stays, but without a significant increase in complication risk[32]. The research conducted by Andelic et al. (2012) highlighted the significance of beginning rehabilitation immediately following the onset of severe "traumatic brain injury (TBI)". According to the study's comparison of the two groups of patients, those in Group A (the early rehabilitation group) fared much better at the 12-month evaluation, with 71% achieving favorable results as opposed to 37% in Group B (the delayed rehabilitation group). Additionally, the study showed that early rehabilitation reduced Disability Rating Scale (DRS) ratings, demonstrating the importance of prompt and ongoing rehabilitation for better functional results in individuals with severe TBI patients[33]. Megha et al. (2013) examined the efficacy of several coma stimulation techniques in a group of thirty comatose patients with "Traumatic brain injury (TBI)" and "Glasgow Coma Scale (GCS)" scores below 8. Group A (n=10) experienced multimodal coma stimulation five times daily for 20 minutes per session, Group B (n=10) underwent stimulation twice daily for 50 minutes per session, and Group C (n=10) received conventional physiotherapy twice daily. After two weeks of treatment, there were statistically significant changes (p

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0.01) between Groups A & C and Groups B & C on the "Glasgow Coma Scale (GCS)" and the Western Neuro Sensory Stimulation Profile. Notably, a high variance ($p < 0.01$) in Western Neuro Sensory Stimulation Profile ratings was detected among the groups, suggesting that shorter, more frequent sessions were more effective, despite no significant difference ($p > 0.01$) in the "Glasgow Coma Scale" [34, 35]. Lendraitiene et al.'s study (2016), rehabilitative outcomes after "Traumatic brain injury (TBI)" were investigated over a spectrum of coma durations. Patients with GCS scores between 3 and 8 were separated into two groups: those in a coma for up to 1 week and those in a coma for more than 2 weeks. Motor function was examined using the Motor Assessment Scale, while mental status recovery was measured with the Mini-Mental State Examination. These results highlight the benefit of shorter coma durations in enhancing recovery, showing that patients in Group 1, who had shorter comas, experienced significantly better recovery in motor function and mental status during acute rehabilitation compared to Group 2[36].

5. Conclusion

The study has evidently shown that the Glasgow Coma Scale increases significantly by providing effective physiotherapy in patients with severe traumatic brain injury. The patients who received such early physiotherapy have improved in terms of Glasgow Coma Scale and other clinical features. The study did not find any association in outcome improvement with that of any specific diagnosis and the sex of the patient. It is noteworthy that the study's diagnostic breakdown uncovered a diverse range of disease prevalence rates, emphasizing the importance of considering the specific nature of traumatic injuries within the research population. The varying prevalence of different diagnoses, such as intracerebral hemorrhage, injuries from car accidents, subdural hematoma, and diffuse axonal injury, highlights the need for individualized treatment approaches customized to the specific diagnosis. Additionally, the over representation of males in the sample population raises concerns about potential gender imbalances that could impact the study's findings. Addressing these gender inequalities is crucial for drawing valid and complete conclusions from the study's results. Overall, these findings underscore the significance of personalized therapeutic approaches in the context of severe traumatic brain injury, taking into account both age-related variations and the specific nature of the traumatic injuries involved.

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