Effect of Intensive Physiotherapy Versus Conventional Physiotherapy on Functional Outcome in Moderate Head Injury Subjects: An Experimental Study

Pandit DD¹, Varadharajulu²

¹Second year MPT, Krishna College of Physiotherapy, Krishna Institute of Medical Sciences Deemed To be University, Karad, Maharashtra 415110, India; ²Dean, Faculty of Physiotherapy, Krishna College of Physiotherapy, Krishna Institute of Medical Sciences Deemed To be University, Karad, Maharashtra 415110, India.

ABSTRACT

Background: Traumatic brain injury is considered to be the most prevalent and severely disabling neurologic disorders. In many hospitals, the physiotherapist manages different orthopaedic, neurological, cardiothoracic conditions. Previous studies suggest that intensity of physiotherapy reduce ICU stay and improve functional status. Although medical and nursing professions have provided 24-hour care, however great variability reported in aggregate sessions out of regular sessions given by physiotherapist.

Methods: 100 clinically diagnosed with Moderate head injury subjects have participated in this study. Each individual was thoroughly examined and assessed through neurological assessment. These subjects were allocated in 2 groups (Intensive Physiotherapy group 3 physiotherapy sessions were given per day and Conventional group 2 physiotherapy sessions were given per day for five days per week for two consecutive weeks). Before and after the treatment protocol subjects were assessed for Consciousness, cognition and functional mobility by Glass Gow Coma scale, Mini-Mental State Examination and Chelsea Critical Care Physical Assessment Tool respectively.

Result: Pre and post-treatment protocol was analyzed by GCS, MME and CPAX using paired and unpaired t-test. Data analysis showed significance for CPAX score ($p < 0.0001$) by unpaired t-test.

Conclusion: The study concluded that giving additional session to the moderate head injury individuals improve their functional mobility in the intensive care unit.

Key Words: Consciousness, Chelsea Critical Care Physical Assessment Tool, Functional mobility, Traumatic Head Injury

INTRODUCTION

To improve the efficiency of rehabilitative care and thus enhance outcomes from brain injury, previous studies have examined various aspects of the delivery of rehabilitative care to survivors of brain injury. Although medical and nursing professions have provided 24-hour care, however great variability reported in aggregate sessions out of regular sessions given by physiotherapist. In traumatic head injury, there is sensory deprivation which is likely to be no consistent input of purposeful stimulus during this period. Due to the deprivation of sensory inputs to higher cortical centres, the remaining areas are deprived of the normal function. To counteract external stimuli is necessary.^{1,2}

Some study suggested that early initiation of a rehabilitation programme can maximize the potential for recovery.³ The rationale behind this recovery is the Sensory Stimulation facilitates dendritic growth and improves synaptic connectivity.⁴ There is evidence which suggests that cortex neural networks need inputs from the sense receptors to sustain their functional efficiency.⁵ The intensity of treatment has a significant role in improving the status of the patient. There is a study which suggested that brain-injured patients who received intensive treatment will show better outcomes than those who receive less intense treatment. Some support for this Anita Slade et al. suggests that giving intensive rehabilitation reduces hospital length of stay.⁶ Increased therapy intensity, particularly physical therapies, enhances function-

Corresponding Author:

Damini D. Pandit, Faculty of Physiotherapy, Krishna College of Physiotherapy, Krishna Institute of Medical Sciences Deemed To be University, Karad, Maharashtra 415110, India; Contact: 7875245924; Email: panditdami071995@gmail.com

ISSN: 2231-2196 (Print)

ISSN: 0975-5241 (Online)

Received: 15.08.2020

Revised: 18.09.2020

Accepted: 05.10.2020

Published: 12.11.2020

al outcomes.⁷ These findings support the assertion that the intensity of treatment is a significant element in achieving good outcomes in post-acute hospital rehabilitation work, especially when one considers the impact on higher cognitive mental processes.

Marsh Konigs et al. suggest that the integration of early intensive neurorehabilitation into the existing chain of care may improve functional outcome of moderate to severe TBI patients.⁸ Shiel et al. compare the intensive rehabilitation (<10 therapy hours/week) with usual care. In between supplementary therapy was provided on request of the multidisciplinary team.⁹ In most settings, conventional therapy received by patients is 1–2 hours per day. However, the usual care intensity can vary less than 1 hour to 8 hours per day.¹⁰

Another aspect of the present study is, in the majority of the conventional settings the given physiotherapy sessions are on call. During the rest of the period various changes occurring in the body as in vitals, the changes occurring in conscious level. Those changes need to be considering while evaluating the condition of the patient. Because when the patient is at its optimal level of alertness the given therapy will emphasize more effect than when the patient is agitated or confused or does not pay attention.¹¹ Every patient has its own time of the day at which alertness its optimal level and to conduct therapy the physiotherapist must find out and modify the patients' schedule. But in conventionally that is not possible as physiotherapist only visiting once or twice daily. Intensive physiotherapy is interpreted as a high level of treatment delivered in a relatively short period. The word intensive in the present study is to stand for the increase sessions in regular business hours for the betterment of the subject. We have already known the conventional treatment sessions that are effective in improving patient's functional mobility and decrease LOS. Then why do we need intensive treatment? The most plausible explanation for this question is that the long LOS of patients who were more disabled to start with not only with a physical disability but having cognitive disabilities as well. It would seem that the long Length of Stay patients, having a greater degree of disability initially, needed more time in rehabilitation treatment to reach the same levels at discharge as the short LOS patients.

It would appear that the shorter the length of stay in the sooner subsequent rehabilitation goals for discharge is achieved. Once the patients are out of the coma, therapeutic rehabilitation efforts should have an optimal intensity to achieve higher cognitive functioning. The lack of hospital beds is also a critical issue, resulting in delays in admission of hypercritical ill patients, delays in transfer from medical Crisis unit to ICU and wards, resulting in increased morbidity and mortality. It would seem that increasing intensity of treatment or adding additional physiotherapy session will improve functional mobility and indirectly decreasing intensive care unit length

of stay. The purpose of the present study was to estimate the effect of providing the additional intensity of therapeutic input to a group of brain-injured patients compared with a conventional group and evaluating the effect of this increase on outcome respecting functional status. Additionally, the study will focus on the availability of physiotherapist is beneficial in ICU working hours.

MATERIALS AND METHODS

The study was conducted in ICU in the period 2019–2020. It was an experimental study, which did involve interventions or experimental structures and was carried out under the ethical and legal supervision of Department of Physiotherapy of the Krishna Deemed to be University Karad in India (026/2019-2020).

Inclusion and Exclusion criteria

The group included patients successively admitted in ICU post-traumatic head injury who satisfied the following inclusion criteria: patient's or caregiver's consent for participation in the study, having GCS score between 9 to 12, patient with a traumatic head injury, age between 25 to 50 year. The following criteria for exclusion were also applied: subjects with the vegetative state, severe Traumatic Brain Injury (GCS = Below 9), associated spinal cord injury, previously diagnosed psychological disorders and unstable subjects, patient's or caregiver's refusal to participate at any point in time of the study preventing assessment of cognitive functions based on the MMSE and functional mobility. Participants and their caregivers were informed about the motive of the study, the participation rules and the possibility to withdraw at any point in time of the study. A hundred patients were included in the research project.

Study design

The subjects were split into 2 groups by simple random technique according to their number of sessions: GA - Intensive Group in which 3 sessions were given per day for five days per week for two consecutive weeks. GB - Conventional group 2 sessions were given per day for five days per week for two consecutive weeks. The given treatment is listed: Continue relaxed passive movements, Active assisted movements, active movements, Chest Physiotherapy, sensory integration and balance exercises. All patients agreed to take part in the study. Moreover, well-oriented participants gave informed consent themselves, whereas participants who were disoriented for time being, consent was given by their caregivers. Each individual was thoroughly examined and assessed through neurological assessment. Before and after the treatment protocol subjects were assessed for consciousness, cognition and functional mobility by GCS, MMSE and CPax respectively. The data was calculated by using software SPSS version 25.

RESULTS

In the present study 100 patients were included. Three patients were vacated because of death. Most common types of intracranial injuries were contusions (56%), followed by subarachnoid haemorrhage (22%), subdural hematoma (12%) and intracranial bleedings (10%). Ages ranged from 25 to 50 years with a mean age of 37.76 ± 9.068 years.

Table No. 1 showed a Comparison of Pre-Pre and Post-Post CPAx between groups. Group A changes were very significant in improving functional mobility when compared with the conventional group. There were extremely significant differences seen in Chelsea Critical Care Physical Assessment tool between group A ($p < 0.0001$) and B. Implementation of the additional session, our data showed the difference in the mean amount physiotherapy sessions received in both the groups (calculated $t = 8.23$, for $p < 0.0001$).

Table 1: Comparison of Pre-Pre and Post-Post CPAx between groups

	Pretest	Post-test
Group a	28.66+5.78	42.12+4.50
Group b	25.2+4.31	33.88+5.45
P- value	0.0010	<0.0001
T- value	3.392	8.23
Interference	Very significant	Extremely significant

Table 2 reveals that Comparison of pre- and post-GCS between groups. The Student t-test revealed no significant difference in consciousness in both the groups ($p = 0.2679$).

Table 2: Comparison of pre-pre and post-post GCS between groups.

	Pretest	Post-test
Group a	10.72+1.12	14.34+0.77
Group b	10.64+1.15	14.16+0.84
P- value	0.7267	0.2679
T- value	0.3505	1.114

Table No.3 showed that comparison of pre-pre and post-post MMSE between groups. There were extremely significant differences seen in Mini-Mental State Examination within group A and B. Group A changes showed significant improvement in functional mobility when compared with the conventional group. There were extremely significant differences seen in CP Ax within group A ($P < 0.0001$).

Table 3: Comparison of pre-pre and post-post MMSE between groups

	Pretest	Post-test
Group a	18.78+2.613	26.46+2.39
Group b	16.84+3.460	24.06+2.543
P- value	0.002	<0.0001
T- value	3.164	4.861
Interference	Very significant	Extremely significant

DISCUSSION

The present study included 100 patients with moderate TBI admitted to ICU. Overall, functional recovery as judged by CP Ax which was quite good in moderate TBI, total score from 37–48 in 95% at post-assessment after 2 weeks. There is a significant difference ($p = 0.002$, $t = 3.154$) in the improvement of GA as compared to GB as additional physiotherapy session was given. The major contributing factors to the improvement in functional mobility in ICU of Group A were the fact that subjects did receive repetitive limb physiotherapy. This enabled these patients to shifted to the ward soon.

There was the improvement in cognition level and functional status in the subjects of both the groups but more improvement was seen in the intensive group this obtained improvement are results of activation of cortical areas such as primary somatosensory cortex, primary motor cortex, posterior parietal cortex, supplementary motor cortex and secondary somatosensory cortex which control cognition and motor activity resulted from without giving motor commands.^{12,13} The GCS score was not quite significant in both the groups with p-value 0.0935 and T value 1.711 as we have included moderate TBI subjects with GCS score 9 to 12 there is a slight improvement in GCS score. The slight improvement is seen due to cortical activation of reticular neurons during limb physiotherapy has been provided to the patient.^{14,15} This activation is obtained by improvement in dendritic growth and synaptic connectivity.^{16,17}

The clinical implication of the Chelsea Physical Assessment tool findings is that treatment plans for those patients who initially manifest multiple disabilities should incorporate a longer treatment time-line. In the present study, the treatment plan is only 2 weeks which might not give a full improvement in functional mobility. Furthermore, such functional incapacities may be more predictive of outcome than several indices of severity of brain injury.

George Spivack conducted a study which enrolled non-comatose 95 TBI patients from inpatient rehabilitation ward in 2 groups depending on the intensity of treatment i.e. 4hours per day and 2 hours per day for 58 days under examination of Rancho scale.¹⁸ The author showed a significant result

for the high-intensity group. In the present study, we have used 3 outcome measures i.e. GCS, MMSE and CPaX which signify consciousness level, cognition status and functional independence. In the intensive group, Three sessions per day treatment are given and in conventional group 2 sessions per day. The previous study distributes treatment hourly by calculating total mean hours used in treatment by other authors in their study, the author included LOS as another outcome measure. In the present study, we have only focus on functional mobility.

In another study conducted by X. L. Zhu included 68 patients with an age group of 12 to 65 moderate to severe TBI patients and randomized into 2 groups 4hrs per day ad 2hrs per day after 20 days of post-injury.¹⁰ Author assesses base score by glass Gow outcome scale, Neurobehavioral cognitive status examination and functional independence measure. The author found that early intensive rehabilitation may improve the functional status of TBI patients.¹⁰

In the present study, we have to use CPaX to measure functional independence as this scale assesses 10 physical abilities. The administration of the tool is simple and can easily monitor the prognosis of the patient.¹⁹ The other aspect of the study is, the moderate TBI has 30 min to 24 hours alteration of consciousness.^{12, 20} We have identified the optimum time for the alertness of the moderate TBI patient which has a good impact on the recovery of the patient. Attention needed for the optimal results, as the attention was navigated to stimulation site M1 excitability occurs in cortical level.²¹ This finding shows the physiotherapist presence is needed for 24/7 to assess and observe changes occurring in patients, even though in the present study we have only covered 8 hours.

There have been only a handful of studies in the area of immediate post-acute hospital rehabilitation treatment outcome in which treatments have been varied, in which LOS has been taken into consideration as an independent and a dependent variable. The present study showed that the availability of physiotherapist is more beneficial and essential in ICU working hours and a particular range of intensity leads to better cognitive outcomes. More research must be done to replicate such findings, especially research that can vary the intensity of treatments and examine effects on both LOS and outcomes over time, and from coma through inpatient discharge and post-discharge. Overall, these outcomes may be helpful when planning resource needs and discharge from ICU. They may also offer guidance when deciding the required services for outpatient rehabilitation.

Certain limitations may make it difficult to specify the findings of the study. The sample size is relatively small, and the regression model can only predict TBI prognosis with care. It needs to be justified up against a larger sample of TBI patients. In the present study, we have a focus on the gross area

of the brain, specific area needs to be investigated. Overall, these outcomes may be helpful when planning resource needs and discharge from ICU.

CONCLUSION

The results of the study suggested that additional physical therapy sessions will improve functional mobility of the patients.

ACKNOWLEDGEMENT

I express my sincere gratitude to all the people who have directly or indirectly contributed and helped me to conduct this research. I would also thank Krishna institute of medical sciences who funded this project and helped me by all possible means.

Conflict of interest: The authors of the study report no conflicts of interest. All authors alone are responsible for the content and writing of the paper.

REFERENCES

1. Megha ML, Harpreet S, Nayeem Z. Effect of frequency of multimodal coma stimulation on the consciousness levels of traumatic brain injury comatose patients. *Brain Inj* 2013;27(5): 570-577.
2. Johnson DA, Roething-Johnston K, Richards D. Biochemical and physiological parameters of recovery in acute severe head injury: Responses to multisensory stimulation. *Brain Inj* 1993; 7:491-499.
3. Mitchell S, Bradley VA, Welch JL, Britton PG. Coma arousal procedure: A therapeutic intervention in the treatment of the head injury. *Brain Inj*. 1990; 4:273-279.
4. Jones R, Hux K, Anderson AM, Knepper L. Auditory stimulation effect on a comatose survivor of traumatic brain injury. *Arch Phys Med Rehabil*. 1994; 75:164-171.
5. Wilson SL, Powell GE, Elliott K, Thwaites H. Sensory stimulation in a prolonged coma: Four single case studies. *Brain Inj*. 1991; 5:393-400.
6. Anita Slade, Alan Tennant and M. Anne Chamberlain. A randomized controlled trial to determine the effect of Intensity of therapy upon the length of stay in a neurological rehabilitation setting. *J Rehabil Med* 2002; 34: 260-266.
7. David X. Cifu, Jeffrey S. Kreutzer, Stephanie A. Kolakowsky-Hayner. The relationship between therapy Intensity and Rehabilitative outcomes after Traumatic Brain Injury: A Multicenter Analysis. *Arch Phys Med Rehabil*. 2003;84: (10):1441-1448.
8. Konigs M, Beurskens EA, Snoep L, Scherder EJ, Oosterlaan J. Effects of Timing and Intensity of Neurorehabilitation on Functional Outcome after Traumatic Brain Injury: A Systematic Review & Meta-Analysis. *Arch Phys Med Rehabil*. 2018;99(6):1149-1159.
9. Shiel a, Burn JP, Henry D, Clark J, Wilson B a, Burnett ME, et al. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. *Clin. Rehabil*. 2001;15:501-514.

10. Zhu XL, Poon WS, Chetwyn CHC, Susanna SHC. Does intensive rehabilitation improve the functional outcome of patients with traumatic brain injury (TBI)? A randomized controlled trial. *Brain Inj.* 2007; 21(7):681–690.
11. Stefan k, Wycislo M, Joseph Classen. Modulation of associative human motor cortical plasticity by attention. *J Neurophysiol* 2004;92:(1):66-72.
12. Blessen C. Eapen, Derrick B. Allred, Justin O'Rourke, David X. Cifu. Rehabilitation of Moderate-to-Severe Traumatic Brain Injury. *Semin Neurol* 2015;35(1):1-3.
13. Hideaki Onishi, Cortical excitability following passive movement. *Phys Ther Res* 2018, 21: 23-32.
14. Bos S. Worldviews on Evidence-based Nursing presents the archives of Online Journal of Knowledge Synthesis for Nursing. *Coma Stimulation* 1997;E4:1-1.
15. Mandeep, Pravin Kumar, Effectiveness of early intervention of Coma Arousal Therapy in Traumatic Head injury patients. *Int J Head Neck Surg* 2012;3(3):137-142.
16. Urbenjaphol P, Jitpanya C, Khaorophum S, Effects of the sensory stimulation program on recovery in unconscious patients with traumatic brain injury. *J Neurosci Nurs* 2009;41(3):10-16.
17. Hotz GA, Castelblanco A, Lara IM, Weiss AD, Duncan R, Kuluz JW. Controlled multi-sensory stimulation therapy for children recovering from severe brain injury. *Brain Inj* 2006; 20(8):879-888.
18. Spivack G, Spettell CM, Ellis DW, Ross SE. Effects of intensity of treatment and length of stay on rehabilitation outcomes. *Brain Inj.* 1992;6(5):419-434.
19. Whelan M, van Aswegen H, Corner E. Impact of the Chelsea critical care physical assessment (CPAx) tool on clinical outcomes of surgical and trauma patients in an ICU: An experimental study. *S Afr J Physiother.* 2018;74(1):450.
20. Teasdale G, Jennett B. Assessment of coma and impaired consciousness, A practical scale. *Lancet* 1974; 2(7872):81–84.
21. Stefan k, Wycislo M, Classen J. Modulation of associative human motor cortical plasticity by attention. *J Neurophysiol* 2004;92(1):66-72.