

Effect of Multimodal Stimulation Along with Music Therapy After Traumatic Head Injury: A Case Study

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Background

Traumatic brain injury (TBI) is a disease that causes varying degrees of consciousness impairment. Some severe TBI survivors recover, while others remain in states of severely impaired consciousness, such as coma or vegetative state. Individuals in a coma are oblivious to their surroundings and have no response to external stimuli. They have the option to recover or progress to verbal stimulation or Multimodal Coma Stimulation. Among various techniques, multimodal sensory stimulation (SS) is a minimally invasive, secure, affordable, and simple rehabilitative strategy that has been extensively researched in individuals with awareness disorders. Research in music therapy in comatose patients has been limited due to the lack of behavioral measures that are sensitive to the complex needs of this population. Hence, we aim to study the impact of multimodal stimulation with music therapy to improve coma and vegetative state after traumatic head injury. Case description: A 45-year-old male was diagnosed with traumatic brain injury with GCS score of 4 And RASS -4 was in coma on ventilator support. It was diagnosed as traumatic brain injury. Intervention: Patient was in Neurosurgery Intensive Care Unit (NSICU) and on conservative treatment before the start of multimodal stimulation (MS) consisting of sensory stimulation, music therapy and auditory stimulation was given. Baseline measurement of Glasgow coma score and Richmond agitation sedation score was taken before and after the therapy. Conclusion: Multimodal stimulation along with music therapy seems to be an effective tool for the comatose and vegetative state patients after traumatic brain injury.

Keywords: Traumatic head injury, Multimodal stimulation, Music therapy, Glasgow coma scale, Richmond agitation sedation scale, music therapy.

1. Introduction

In India, traumatic brain injury (TBI) is a significant public health issue. Each passing year has seen a notable rise in TBI due to India's expanding economy, as well as population expansion, industrialization, and motorization.(Pruthi et al., 2012). TBI causes deaths, injuries, and disabilities in people of all ages, but it affects young, active people more than older people and more often affects men than women. India comprises of 29 states and 7 union territories. It is second most populous country in the world with estimated population of 1.38 billion during 2020-2021. (Agrawal et al., 2016) Traumatic head injury can be a cause for mortality, morbidity, disability, functional loss and socioeconomic loss in developing countries like India. Traumatic head injury is an acquired brain injury which causes brain dysfunction that is due to external force and external blow. Traumatic brain injury leads the patient to coma or in a vegetative state.2 Till now the only drug therapy has been addressed to improve the patient's

GCS and sedation, no other treatment showed the efficient results in patients with severe brain injury (Yekefallah et al., 2020). Literature states that the progression from coma or vegetative state is slow and challenging for patients as well as the doctors. For years now, the sensory stimulation treatment is more frequently used in rehabilitation programme for neurological disorders like coma.(Yekefallah et al., 2020). These are the programme which are based upon the theory of Environmental benefits brain plasticity and enhance brain function. (Schnakers et al., 2016) Approximately 1.5 to 2 million persons are injured, out of which 1 million people lead to death every year in India. Road traffic injuries are the leading cause (60%) of brain injury followed by falls (20% - 25%) and violence (10%) (Hu et al., 2021). As per previous studies that prolonged coma or vegetative state follow TBI in one out of eight patients. 52% of vegetative state survivors from TBI improves and regain consciousness within one-year post-injury and 40% improves to ta higher GCS within six months and remaining individual die or

remain in a vegetative state for months or years. In past few years it has been stabilize that the severity of head injury can directly affect the patient's and family's quality of life thus the ICU care, advance technologies and medicine can progress the chances of survival of patient. However, the Quality of life after survival is very poor and there are less chances of restoration of functional independence. There are so many patients who experience alteration in level of consciousness whether they survive or not (Formisano et al., 2001). Effect of frequency of multimodal coma stimulation on the consciousness levels of traumatic brain injury comatose patients and found that the effectiveness of multimodal coma stimulation in improving the consciousness levels of TBI comatose patients when compared to the control group. The result suggested that the use of high frequency are more beneficial and continuous efforts to improve the comatose patient with multimodal coma stimulation in early brain injury patients (Megha et al., 2013). As per ICF the contextual factors of patients personal and environmental gets effects and not only patient faces the challenges also the family who suffers a lot with problems related to personal and environmental berries. The patient caregivers bound to responsibilities and end up by compromising participation which effects care givers mental and physical health.¹ So this refers that the coma and vegetative state should be addressed with stimulation and various coma arousal therapies so that patient's progression enhances (Scale & Childs, n.d.). Although there are many symptoms which are seen after traumatic brain injury (TBI) like cognitive, behavioral, gastrointestinal issues, speech difficulty etc. but the major issue is prolonged unconsciousness (COMA) or altered consciousness (vegetative state). Long term loss of consciousness can cause poor physical and mental functions in patients (Yekefallah et al., 2020). Long term care of these patients needs nursing care, physical therapist and other medical help which eventually increases the overall cost and burden on the families (Megha et al., 2013). There are numerous studies has been done on sensory stimulation program which shows recovery in patients with coma and semi-conscious conditions. According to literature music therapy interventions using live music which can be modified according to patients' responsiveness. Music parameters can be change according to the progression in patient's attention and arousal.⁴ Music therapy can also be given in association with salient contents such as name of patient, family members and close one's in musical material. These silent auditory stimuli such as voice of family members and closed one's will increase probability of observing brain activity and behavioral responses of patients. Researchers have recommended that early initiation of rehabilitation programme will maximize the ultimate potential for recover. Research into sensory stimulation as music

therapy has been addressed less due to the measures for behavioral are less and sensitive to complex need of patients with coma and vegetative state. For this reason, single subject style and case report prevail on activity and neuroscience outcome. One case study assessed the consequences of recorded music on a learned behavior though conditioning. Result incontestable that music may well be a remarkable reward and will facilitate one detective work sings of consciousness (Schnakers et al., 2016). A study on sensory stimulation and music therapy programs for treating the disorders of consciousness and concluded initiating such an enormous project is difficult however it is crucial since effective treatment choices area unit restricted. The mixture of these scientific findings will facilitate the clinicians to treat additional with efficiency patients with severe brain injury (Schnakers et al., 2016). It is important to improve the prolonged unconsciousness (COMA) or altered consciousness (vegetative state) of the patient for further recovery (Yekefallah et al., 2020). There are various methods to improve the coma state or vegetative state after traumatic brain injury. Multimodal stimulation therapy is some of the therapies which can improve the consciousness level in the patients. Hence the aim of the study is to evaluate the impact of music therapy along with multimodal stimulation.

2. Case Presentation

History

A 45-year-old male met with a road traffic accident on 25-06-22 at Kotputli, near Jaipur Delhi highway and admitted to Emergency ward Nims hospital, Jaipur. There were multiple injuries on hand, leg and bleeding on the head and ear. After Radiological investigation (CT scan), it was diagnosed as right-side contusion of frontal, Parietal and temporal lobe which led him to vegetative state. Chest X-ray was clear with no secretion and rib cage injury. Patient was put on ventilator SIMV mode with 60% Oxygen.

Physical therapy examination

The patient was referred for Physiotherapy ICU management in NSICU. As per Our initial assessment we found patient is in vegetative state and the GCS score is E1 V1 M2 and RASS -4. On observation Patient was in a supine position, the Intra venous line was placed at the left side of forearm. The Muscle tone was normal on Ashworth scale with scores of 4. In sensory evaluation the patient was responding to pain stimulation and eye opening on verbal stimulation.

Physiotherapy Intervention

Before commencing the physiotherapy, treatment Patient's Attender was informed about the condition and intervention, and an informed consent was obtained. Conventional physiotherapy management included chest physiotherapy, active inhibition technique, positioning, passive movements for upper and lower limb along with coma stimulation by using music therapy with his choice of songs (asked

to attender) were played, Verbal stimulation and sensory stimulation. The frequency, duration and intensity of interventions are shown in table no 1. Progression for the intervention was given as per table no 2. Baseline measurements of GCS and RASS score was taken pre and post intervention as shown in table no 3. The treatment plan was scheduled three times a day. After 7 days of intense physiotherapy along with MS and music therapy with a total number of 27 sessions. The outcome measures showed a significant improvement in GCS and RASS score (Table No 4).

3. Method and Procedure

Patient was observed and examined initially. Inform consent was obtained from family member. The baseline assessment was done, and the GCS scoring was found to be 4, RASS score was -4. A Total 1 week of Chest and Limb physiotherapy along with Multimodal stimulation included pain stimulation on great toe with full extension and flexion. Coma arousal therapy specific to auditory stimulation was given by repeating names of the attendants, name of the patient himself and names of close relatives. However, sensory stimulation was provided using pin prick and light touch at different dermatomes of the body and music therapy was given after the multimodal stimulation. For first two days, slow and soft music was played for 5 minutes of effective treatment, which indicated that the intervention based on the idea of sensory stimulation should be given in coma or vegetative state (Ffl et al., 2009). So, we can summarize that MS with Music therapy appear to be most beneficial in patients post TBI. This Protocol for Patient with traumatic brain injury is beneficial which will help patient to recover, survive, and will help patients to improve at earliest. So that patient's functional limitations will be less. For more robust conclusions, a prospective trail is needed.

Qualitative experience

Patient's attender shared the review on our protocol, and he was quite happy and positive toward the health benefits with multimodal stimulation. He also mentioned that he doesn't mind if patient's name uses on the case report, or his condition is being discussed. According to the attender we should on 3 th and 4 day and changed to music with continue our treatment protocol so that the lyrics was played on 5th and 6th day progressing to patient's favorite music on 7th day. After this course of intervention, the follow up was taken where GCS score increased to 9 and RASS score was -2 which means light sedation. The conventional Physiotherapy treatment was given as following: Chest physiotherapy: Active inhibition technique,

Respiratory PNF, Positioning with pillows, Limb Physiotherapy: Passive movements for upper and lower extremities.

Study Implication

The patient outcomes showed improvement in coma and Vegetative state as shown in figure no 1 and 2. His Level of consciousness and sedation state also improved. A review study was conducted on sensory stimulation for brain injured individuals in coma or vegetative state and concluded that out of 68 patients in total three studies concluded that there was no significant effectiveness of multisensory program in patients in a coma or vegetative state and stated that thecurrent update in this field should be improve as well as the dearth patient gets better soon with good health condition.

Conflict Of Interest: Authors declared that there is no conflict of interest

Institutional Study Review Board: Nims College of physiotherapy and occupational therapy Rajasthan, Jaipur

Author Contributions

NV conceived and designed the study. AG, JS, conducted research and collected data. MS and NV, NK wrote the initial and final draft. AG, NK, HM. provided the logistic support. All authors have critically reviewed and approved the final draft and are responsible forthe content and similarity index in the manuscript.

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Table No 1 Initial Exercise Protocol

S. NO	Treatment protocol	Dosage	Repetitions
1.	Chest physiotherapy (percussion, vibration, and shacking)	3 times a day	5 Rep
2.	Active inhabitation technique	3 times a day	5 Reps with 5 second holdwith grades
3.	Respiratory PNF techniques	3 times a day	5 Reps each
4.	Positioning: with support of pillow	Every 2 hourly change the position with support of pillow	NA
5.	Passive movements forupper extremities	Shoulder Flexion/Extension Abduction/adduction Internal and external rotation	3 times a day 5 Reps
		Elbow flexion/extension	3 times a day 5 Reps
		Wrist flexion /extension/ulnar deviationand radial deviation	3 times a day 5 Reps
6.	Passive movements forLower extremities	Hip Flexion/Extension Abduction/adduction Internal and external rotation	3 times a day 5 Reps
		Knee flexion/extension	3 times a day 5 Reps
		Ankle dorsu/planter flexionas ankle toe movement	3 times a day 20 Reps
7.	Coma stimulation	Sensory stimulation	3 times a day 10 Reps
		Music therapy	3 times a day 05 mints
		Auditory stimulation	3 times a day 5 Reps

Table No. 2 Progression to be followed by this protocol.

S.No	Treatment protocol		Dosage	Repetitions
1.	Coma stimulation	Sensory stimulation	5 times a day	15 Reps
		Music therapy	5 times a day	10 Minutes
	Auditory stimulation	5 times a day	10 Reps	

Outcome Measures

Table No 3

Outcome measure	Before	After
GCS	4	9
RASS	-4	-2

Table No 3: Shows the base line, pre and post values for GCS and RASS

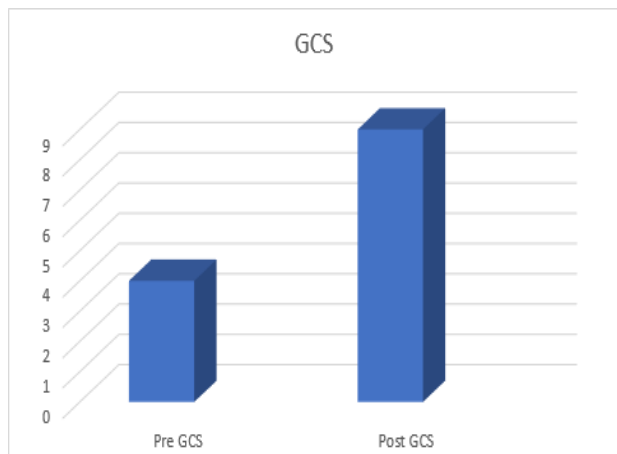
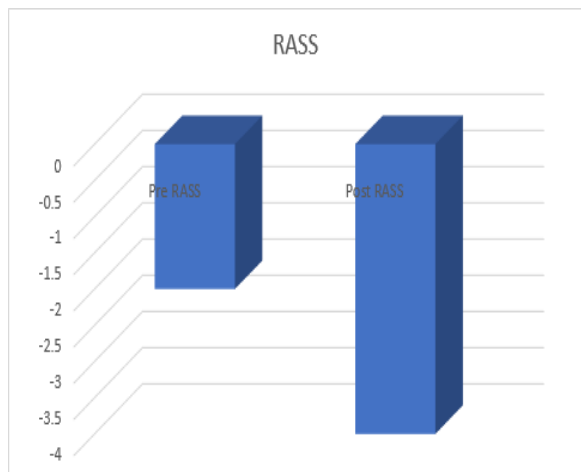


Figure No. 1 shows that the GCS score has been changes for pre and post with values as pre-



GCS which is 4 and Post GCS is 9.

Fig No 2 this graph shows the difference in RASS pre value as -4 and post values as -2

Annexure I

TABLE 38-2
Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	Best response	15
	Comatose client	8 or less
	Totally unresponsive	3

Richmond Agitation-Sedation Scale (RASS)

Score	Term	Description	
+4	Combative	Overly combative, violent, immediate danger to staff	Verbal Stimulation
+3	Very agitated	Pulls or removes tube(s) or catheter(s), aggressive	
+2	Agitated	Frequent nonpurposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressively vigorous	
0	Alert and calm		
-1	Drowsy	Not fully alert but has sustained awakening (eye opening/eye contact) to voice (≥10 seconds)	Physical Stimulation
-2	Light sedation	Briefly awakens to voice with eye contact (<10 seconds)	
-3	Moderate sedation	Movement or eye opening to voice (but no eye contact)	
-4	Deep sedation	No response to voice but movement or eye opening to physical stimulation	
-5	Unarousable	No response to voice or physical stimulation	

Annexure II

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