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Research article

Comparing the effect of multimodal sensory stimulation program and median nerve stimulation on the level of consciousness in adults with severe head injury

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ABSTRACT

Head injury is one of the most common causes of morbidity and disability among young individuals and primarily caused by motor vehicle accident which leads to altered level of consciousness, temporary or permanent physical and cognitive disabilities. The multimodal sensory stimulation therapy and median nerve stimulation helps to regain consciousness level in early phase of recovery.

The present study is to compare the effectiveness of multimodal sensory stimulation program and median nerve stimulation on the level of consciousness in adults with severe head injury.

40 male and female subjects with severe head injury were selected for the study, after received inform inform consent from their relatives. All the patients were assessed and divided into two groups by simple random sampling. Group- A intervened by multimodal Sensory stimulation program and Group-B intervened by multimodal Sensory stimulation program and Group-B intervened by median nerve stimulation along with both groups received conventional physiotherapy. The Pre and Post treatment data score of GCS and CRS were recorded at the beginning and after completion of 4 weeks intervention.The data was collected and analyzed by unpaired t-test for inter group analysis between (group A and group B) and paired t-test for intra group analysis as data was normally distributed. There was a statistically significant ($P<0.0001$) improvement in GCS and CRS score in both the groups.

After 4 weeks of intervention, there was a significant improvement in level of consciousness in both the groups. Group- A which intervened by multimodal sensory stimulation is associated with higher levels of consciousness determined by GCS and CRS when compared to group-B which intervened by median nerve stimulation in comatose head injury patients.

Keywords: Severe head injury (HI), Multimodal sensory stimulation program (MSSP), Median nerve stimulation (MNS), Glasgow coma scale (GCS), Coma recovery scale (CRS).

INTRODUCTION

A head injury is a gross term that involves a wide-ranging of injuries that occur to the scalp, skull, brain, underlying tissue and blood vessels as well in the head. Head injuries are also commonly known as brain injury or traumatic brain injury depending on the severity of the head trauma. It is defined as “A disturbance in brain function, or

other sign of brain pathology, caused by an external force. The brain injury is a non-degenerative or non-congenital damage to brain caused by an external mechanical force that may produce an altered level of consciousness leading to temporary or permanent cognitive, physical and psychosocial impairments [1].

The principal Mechanisms of Severe Head Injury are as Follow

Focal brain injury caused by direct contact injury which may lead to contusion or intracranial hemorrhage

Diffuse axonal injury caused by acceleration or deceleration injury mechanism which results in concussion or brain swelling [2].

Majority of head injury victims get disorder of consciousness (DOC) which is a life threating consequence of severe Head injury and associated with a wide spectrum of neuromuscular, cognitive and behavioral impairments results in decrease in quality of life. DOC primarily include Coma, vegetative state (VS) and minimally conscious state (MCS). Glasgow coma scale is commonly used to assess the level of consciousness with high validity and reliability.

So, the early and consistent rehabilitation can promote recovery and lower the risk of complication. At this stage only conventional physiotherapy is not sufficient because coma patient suffers from sensory deprivation. In the early phase of rehabilitation some newer approach like Multimodal sensory stimulation technique, median nerve stimulation can be used to improve level of consciousness in head injury patients [3].

The implementation of Multimodal sensory stimulation program at early stages of recovery can gain favorable outcomes. Multimodal sensory stimulation program consists of different kind of sensory stimuli such as auditory, visual, tactile, olfactory, gustatory and kinesthetic stimuli. All of these stimuli were given by locally available items like soft brush for tactile stimulation, family photos for visual stimulation, familiar voice or favorite songs for auditory stimulation, patients preferred perfumes before injury for olfactory stimulation etc. and it is easy to administer even patients relative can do under the guidance of therapist [4].

The use of electrical stimulation via Median nerve is newer potent intervention to facilitate recovery from coma. The mechanism behind the MNS improves consciousness level are not completely clear and very limited literature are available to prove the effectiveness of MNS in head injury patients. Cooper explained the exact mechanism behind the RMNS leads to enhance consciousness level. Peripheral stimulation of median nerve carries afferent inputs to Ascending Reticular Activating System (ARAS), through spine-reticular tract which further connects with the intraluminal nuclei of the thalamus and stimulate the entire.

Central nervous system7. Jin lei showed that RMNS act as a simple, efficient and non-invasive way to promote the recovery of subjects with coma in early phase of rehabilitation [5].

MATERIALS AND METHODS

Study Design: "Comparative study

A total 55 numbers of patients were diagnosed with severe head injury by Neurosurgeon were selected as subjects who fulfill the inclusion criteria. Out of which 10 died, 3 patients relatives were denied for consent and 2 subjects tooked discharged from the hospital prior to completion of required intervention.

So, total N-40 subjects were assigned into 2 groups i.e., 20 subjects in (Group A) and 20 subjects in (Group B) by simple random sampling method. Out of 40 subjects there were 35 male patients and 5 female patients. A Written Consent form was received from patient's close relatives after explaining the procedure and its outcomes. A pre intervention assessment was done via Glasgow coma scale (GCS) and coma recovery scale (CRS). Group-A received multimodal Sensory stimulation program and Group-B received median nerve stimulation, along with both the group received conventional therapy as chest PT, Passive Movement, and positioning of the patient as well. The treatment was given for 4 weeks; 5 sessions per week, 30 minutes/session twice a day. Post intervention assessment was taken after completion of 4 weeks.

Intervention

Group a-multimodal Sensory Stimulation Program

Since, there is no standard protocol for multimodal sensory stimulation so, on the basis of literature six sensory modalities are choose for a multimodal sensory stimulation program i.e., Kinesthetic, auditory, visual, tactile, olfactory, and gustatory stimuli. All of these stimuli were given with the help of coma kit. Mostly Familiar stimulations were used and also encouraged the family members to bring patients favorite items like perfumes, objects, and voice recording of loved one and photos [6].

The program included the following stimulation.

Kinesthetic stimulation – starts with change in posture of patient, then rolling side to side, movement of arms, legs and movement of head (turned from side to side).

Auditory stimulation – The patient's favorite music with the help of earphones or taped recordings of the voice of the patient's family members or direct Talking, Ring bells etc. were given [7].

Visual stimulation – A picture of the family member or friends, light of torch, colorful cards, mirror etc was presented to the patient. The picture was slowly moved to right and left sides then up and down. If the patient's eyes were closed, they were kept open with one hand.

Olfactory stimulation –The patients preferred fragrances of perfumes, scented sticks, were applied underneath the patient' snooze.

Gustatory stimulation – The flavor which patient like the most were applied or lemon juice and variety of other essences etc. A stick soaked of this flavour was introduced into the patient's mouth.

Tactile stimulation – A holding hands and soft brush was applied to bilateral upper and lower extremities. The patient's lips, were touched with the tip of a pen or spoon.

Duration – 4 weeks; 5 sessions per week, 30 minutes/session twice a day.

Figure1: Kinaesthetic stimulation Self- Illustration

Figure 2: Gustatory stimulation Self-Illustration

First session was given by the investigator, second session by the family members under supervision of investigators.

Group B – right Median Nerve Stimulation

Parameters (The parameters of RMNS were chosen as per the previous studies)

Patient position: Supine lying

Type of current: Faradic current

Wave form: Asymmetrical biphasic

Pulse duration: 300 ms

Pulse frequency: 40 Hz

Pulse amplitude: 15-20 mA (as tolerated)

On time: 20 sec/ min •

Off time: 40 sec/ min

Intensity

Intensity managed until visible contractions was seen like thenar abduction and flexion and flexion of index and middle finger.

Active Electrode

Flexor aspect of right-side forearm

Inactive Electrode

Flexor aspect of lower 2/3 of right-side forearm

Duration: 4 weeks; 5 sessions per week, 30 minutes/session twice a day.

Figure 3: Showing Median Nerve Stimulation Self Illustration

Conventional Physiotherapy Treatment

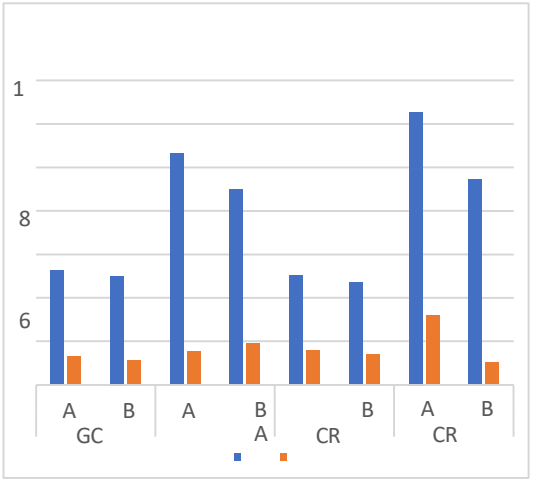
Appropriate Therapeutic Positioning and Regular Turning (every 2 hours) was done to Prevent complications such as - pressure sores, contractures, pain and respiratory problems etc.

Passive ROM exercises (bilateral upper and lower limbs)

Chest Physiotherapy

Duration: once a day for 4 weeks.

Figure 4: Graph showing Comparison of pre and post intervention scores of GCS and CRS between group A and group B



Statistical Analysis

An overall 40 subjects with severe head injury were taken for statistical analysis and the collected information of all these subjects were entered into the computer database. The data was analyzed by using IBM SPSS version 20.0 (statistical package for social sciences) and the results on continuous measurements were presented in numbers (%) [8].

Table 1: Gender Distribution between group A and group B

Gender	Group A	Group B	Total
Male	17 (85.0%)	18 (90.0%)	35 (87.5%)
Female	3 (15.0%)	2 (10.0%)	5 (12.5%)
Total	**20**	**20**	**40 (100.0%)**

Table 2: Mechanism of Head injury between group A and group B

Mechanism of injury	Group A	Group B	Total
Assault	2 (10.0%)	3 (15.0%)	5 (12.5%)
Fall	0 (0.0%)	2 (10.0%)	2 (5.0%)
MVA	18 (90.0%)	15 (75.0%)	33 (82.5%)
Total	**20**	**20**	**40**

Table 3: Comparison of pre and post intervention scores of GCS and CRS between group A and group B

Variables	Group code	Mean ± SD	unpaired t test	p-value
GCS pre	A	5.25±1.29	0.653	0.518
	B	5.00±1.12		
GCS post	A	10.65±1.53	4.134	<0.0001
	B	9.00±1.91		
CRS pre	A	5.05±1.57	0.739	0.464
	B	4.70±1.41		
CRS post	A	12.55±3.18	4.132	<0.0001
	B	9.45±1.05		

DISCUSSION

Altered level of consciousness is very common among individuals who sustain severe head injury. Approximately one third population of severe head injury was remained in persistent vegetative state. Therefore, for rapid recovery use of some newer techniques like multimodal sensory stimulation, median nerve stimulation along with conventional physiotherapy to obtain better prognosis and outcomes [9].

The current study was conducted to compare the effectiveness of multimodal sensory stimulation program and median nerve stimulation on the level of consciousness in adults with severe head injury. The result showed a significant difference between the group A and B (P<0.0001) on GCS and CRS that means multimodal sensory stimulation technique were found to be effective in improving the level of consciousness as compared to median nerve stimulation in comatose patients with head injury [10].

The result also revealed a significant difference (P<0.0001) within the groups calculated by pre and post intervention score of GCS and CRS. Group B i.e., median nerve stimulation also showed a significant difference (P<0.0001) in pre and post intervention values of GCS and CRS.

So, this result suggest that median nerve stimulation is also a helpful way to improve consciousness level in head injury patients [11].

List of Abbreviations

Severe head injury (HI), Multimodal sensory stimulation program (MSSP), Median nerve stimulation (MNS), Glasgow coma scale (GCS), Coma recovery scale (CRS).

Conflict of Interest: None

Source of Funding: None

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