

Effect of early modified intense multisensory stimulation on glasgow coma score in children with non -traumatic neurological insult

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Abstract

Background: Coma indicates prolonged state of unarousable sleep and disturbance of consciousness, usually resulting from lesions involving reticular formation.⁶ Modified Intense Multi-sensory Stimulation (MIMS) is intended to promote awakening and enhance the rehabilitative potential of brain-injured patients in a coma or vegetative state. It includes auditory, tactile, gustatory, visual and olfactory stimulation. **Aim:** To find effects of early MIMS on Glasgow coma score on children with non traumatic neurological insult. **Method:** 60 children with unconsciousness due to non-traumatic lesions were, randomized for control and experimental group. Experimental group received MIMS for 30-40 minutes per day for 2 weeks. Control group received passive movements and positional changes as traditional physical therapy for 30-40 minutes. **Result:** Mann-Whitney test analyzed the difference in GCS score to be significant. The rate or steepness of slope was found to be more for experimental group than control group. The intra group comparison i.e. the comparison within the scores of auditory, visual, olfactory, gustatory and tactile was done using Wilcoxon sign rank test. Auditory, Visual, Olfactory and Gustatory changed scores showed p value of 0.0078, 0.001, 0.031, 0.005 respectively. The overall MIMS changed score demonstrated p value of 0.0625 which is non-significant. **Conclusion:** MIMS improves the quality and quantity of arousal in children with unconsciousness due to non- traumatic causes. Thus MIMS can help reduce the coma stage.

Key Words: Coma, MIMS, neurological injury, arousal, children.

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INTRODUCTION

Consciousness may be considered as state of activity in brain which enables it to exert any of its functions as “mind”. The word coma is derived from the Greek word: Koma, meaning deep sleep. It indicates prolonged state of unarousable sleep and disturbance of consciousness,

usually resulting from lesions involving reticular formation of the brain stem, the hypothalamus and connection with the cerebral hemispheres¹. Coma is produced by two broad groups of problems morphologic or metabolic. Glasgow coma scale -Teasdale and Jennett (1974) developed the GCS as an aid in the clinical assessment of post traumatic unconsciousness. The GCS has 3 components: eye (E), verbal (V) and motor (M) response to external stimuli. The scale consists of 15 points. The best or highest responses are recorded. Non traumatic coma in childhood is an important pediatric emergency. Neurological outcome is often of foremost concern to parents and healthcare team. It may range from absence of impairment to severe disability or death. Etiology of coma and clinical status at the time of presentation are likely predictors of outcome. Literature on pediatric non traumatic coma is rather inconclusive, and most of these are retrospective. Very little

information is available particularly so from developing countries including India.⁶ Modified Intense Multi-sensory Stimulation(MIMS) is intended to promote awakening and enhance the rehabilitative potential of brain-injured patients in a coma or vegetative state. Protocol involves stimulation of any or all of the following senses: visual, auditory, olfactory, gustatory, cutaneous and kinesthetic. Various stimuli may be used for each sense. The MIMS protocol also allows therapist to assess response given by child to each stimuli. Auditory stimulation is provided by familiar people like parents, favourite song spoken or sung to the child. The response is blink or head turning briskly. Response to auditory stimulus is graded as 1) No reaction to loud stimulus, 2) Patient startles appropriately to loud stimulus.3) Turns head to voice. 4) Follows commands. Visual stimulation is done by flashing bright coloured papers or flash cards. The response considered was eye blink or movement of head. The scoring recommended is 1) Pupil dilated with no response to light., 2) Pupil constrict appropriately to light, 3) Eyes track moving object, 4) Perceives color and light, 5) Recognizes written or pictorial images. Olfactory stimulus is suggested to be done using very strong pungent odours. We have used however vanilla essence and coffee powder. The notable response is withdrawal and scoring is 1) No reaction, 2) Nose twitching, 3) Turning of head. Gustatory stimulation is done using a cotton swab dipped in sugar syrup and rolled on tongue of child. The response that may be seen is facial flush or swallowing. Scoring for response to gustatory stimulation is 1) No swallowing or cough reflex, 2) Poor swallow reflex, saliva drool, 3) Inability to open mouth, 4) Tongue moves food efficiently for swallow,5) Patient eating semisolids, 6) Patient drinking fluids. Tactile stimulation was performed using pressures, touch at various regions of body. The response considered is verbal or withdrawal. The scoring is 1) No response to deep pain, 2) Withdrawal to painful stimulus, 3) No response to light touch, pressure. Regular scorings of GCS and MIMS may indicate changes if any in the child in coma. Thus the purpose of the study was to find out

efficacy of MIMS on GCS in comatose children with non traumatic neurological injury.

MATERIAL AND METHODS

Ethics approval was sought for the study from IEC of KEM hospital. 72 children in age group 3 years to 11 years in coma due to non traumatic causes in paediatric wards of Seth GSMC and KEM hospital, Mumbai were included and screened for exclusion criteria. The study was carried out from August 2014 to September 2015. Children who were given sedatives, anticonvulsants, CNS depressants or tranquillizers were excluded from study. Also children with known sensory damage, cerebral palsy, or progressive neurological insult i.e. > 1year were excluded from the study. The purpose of the study was explained to the child's parents and written consent was taken from them. Children were then assigned to either of the Control or Experimental groups according to computer generated numbers. Comatose children were assessed for sensory, motor system, Glasgow coma score, tone, reflexes, cranial nerve examination, blood pressure, pulse rate, respiratory rate. GCS and MIMS stimuli scores were measured on 7th and 14th day also. Wood's sensory regulation program was used i.e. all the children were stimulated in quiet environment using ear plugs. Both groups received therapy for 30-40 minutes 6days per week for 2 weeks by 2nd author. Hand outs for positional changes were given to the parents of children of both groups and advised to make the child sit up with support 3 -4 times in the day. Stimulation was given to the experimental group via 5 sensory modalities i.e. auditory, visual, olfactory, gustatory and tactile. One system was stimulated at a time with 2-3 minutes rest in between to prevent overstimulation. MIMS program was administered by 2nd author, 6 days a week. Auditory stimulation was given by parents and relatives who talked with child near his face with soft firm voice. Visual stimulation was given by bright and light color papers. Olfactory stimulation was given by vanilla essence. Gustatory stimulation was given by cotton swab dipped in sugar syrup and rolled on child's tongue.

RESULTS



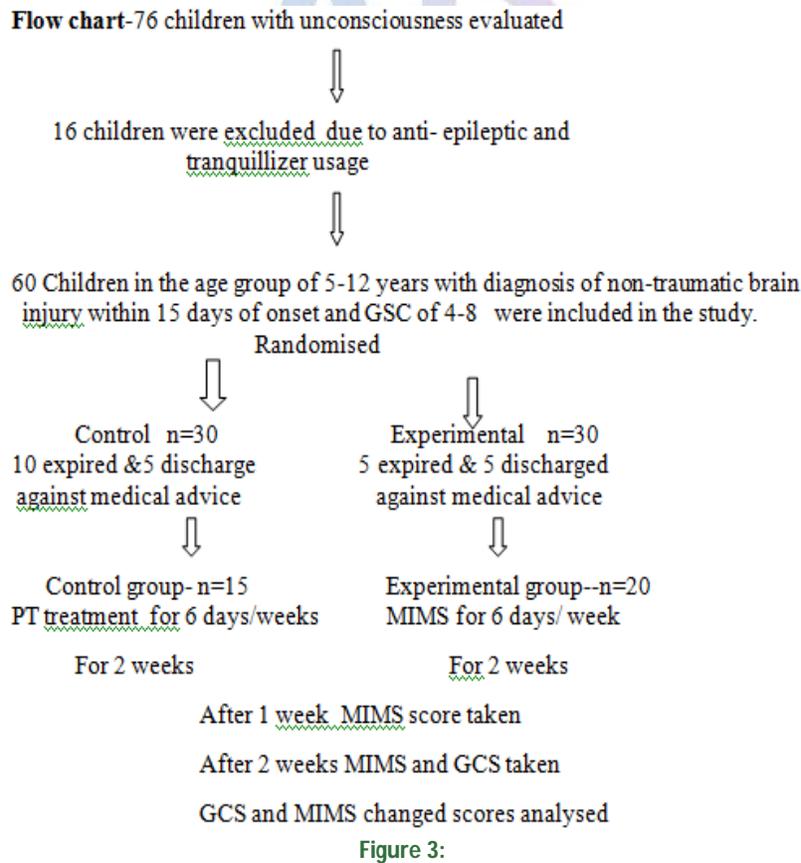
Figure 1:



Figure 2:

Tactile stimulation was given by maintained touch, pressure to oral area, slow stroking of spine, feather or sponge down, limbs first one side then other, increased pressure against muscles: grasping a muscle and maintaining the pressure for 3-5 seconds, stretching a tendon and maintaining the stretch for few seconds and rubbing the sternum, top to bottom limbs, first one side

then other. Sub noxious pressure was given to temporo-mandibular junction, trapezius muscle, finger nail beds up to 5 seconds. Control group was given range of motion exercises, changes in body position such as single or repetitive roll with faster movement patterns for 30-40 minutes i.e. same as experimental group.



Statistical analysis was done using non-parametric tests as the data obtained was not normally distributed, as analyzed using Kolmogorov Smirnov test for normality. The GCS before the experiment was compared between the groups with help of Mann-Whitney test. They were similar.

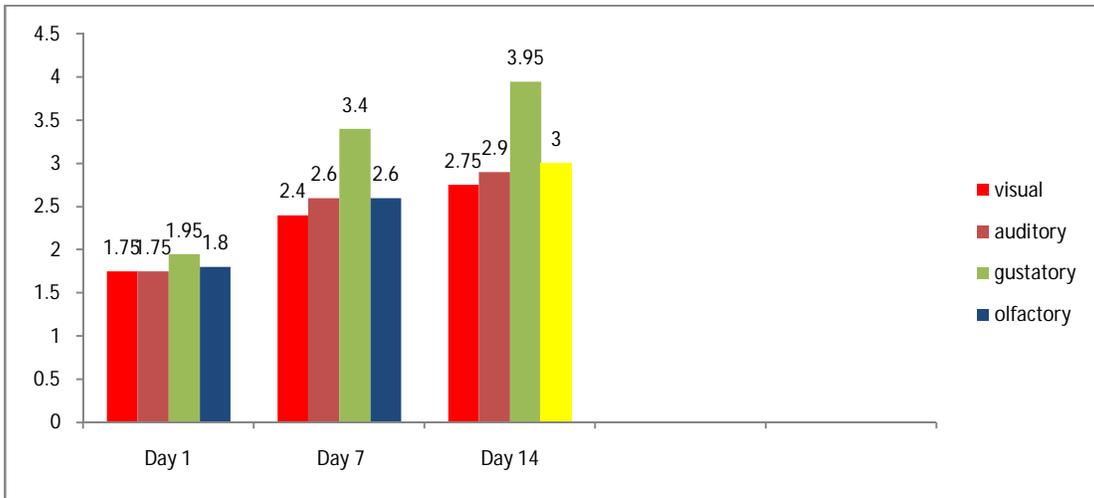


Figure 4:

MIMS score was analysed by Chi Square test. The median MIMS score changed from -45.5(p value 0.0002) (S) to -7.5(p value 0.0625) (NS) for auditory; -33(p value 0.001)(S) to -18 (p value 0.0078) (S) for visual; -68 (p value 0.0001) (S) to -14(p value 0.0156)(S) for olfactory; -52.5 (p value 0.0001) (S) to -10.5(p value 0.0313) (S) for gustatory; and -39 (p value 0.005) (S) for tactile senses in 1st week to 2nd week. Tactile score did not change in 2nd week. We analyzed the difference in GCS score but we don't know the group for which the rate of change in GCS was more. To decide the rate or steepness we made use of slope.

Table 1:

	Experimental	Control
1st day	6.6	7
14th day	10.75	9

Blue line is for experimental and green line is for control. Point on blue line at week 1 (1st day) indicates mean score of experimental group on 1st day and a point at week 2 (14th day) indicates mean score of experimental group on 14th day. Point on green line at week 1 (1st day) indicates mean GCS score of control on 1st day and on week 2 (14th day) indicates mean GCS score of control on 14th day. From graph it is clear that the GCS score for both the groups is increased. However steepness or extent of increase is more for experimental group.

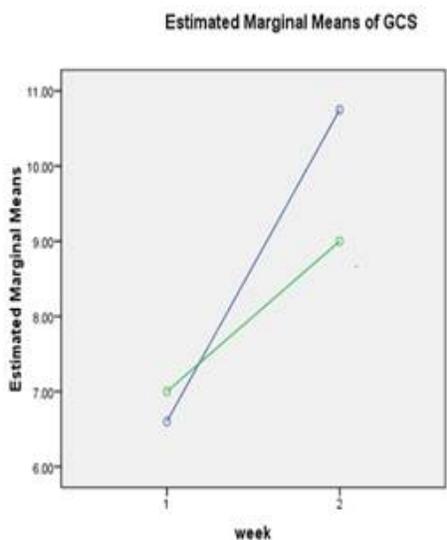


Figure 5:

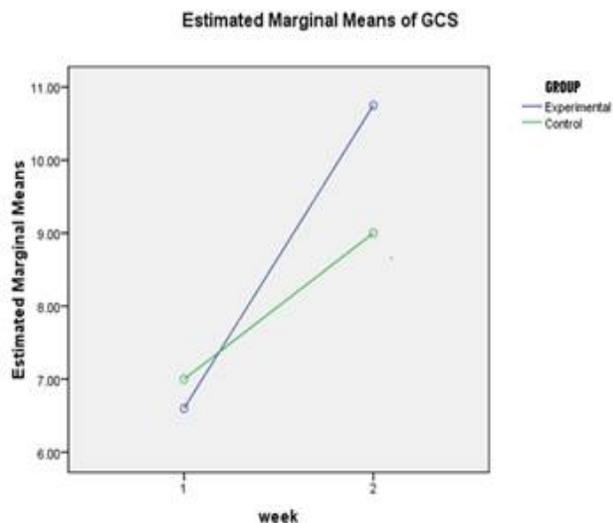


Figure 6:

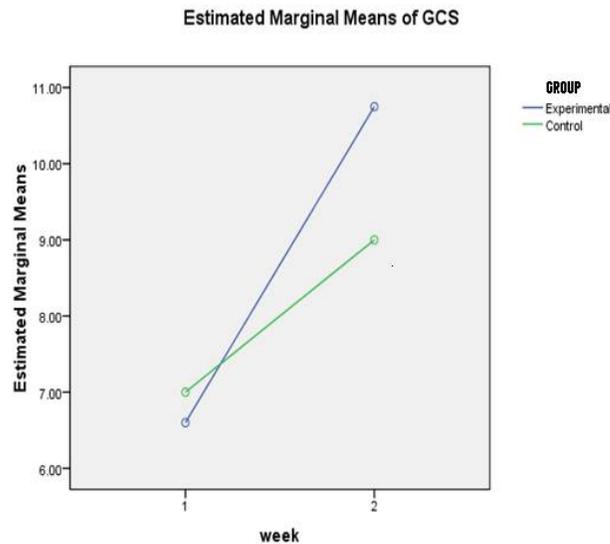


Figure 7:

Table 2:

Slope For Experimental	4.15
Slope for Control	2

Slope for experimental is more than slope for control. Hence for experimental group GCS score increased rapidly than control group.

Results

- There was a significant difference in GCS on 14th day in the experimental group as compared to the control group.
- A significant difference was found in the mean scores for auditory, visual, olfactory, gustatory and tactile stimulations between 1st and 7th day.
- A significant difference was found in mean scores for visual, olfactory and gustatory stimulation between 7th and 14th day.
- No significant difference was found in the mean scores for Auditory and Tactile stimulation between 7th and 14th day.

DISCUSSION

Organs of various systems in body need rest for recovery from disease, whereas nervous system needs rest as well as stimulation. It is believed that recovery from disease will automatically lead to recovery of consciousness. This does happen but not always.¹¹The cornerstone of MIMS approach is a fact that the human brain grows by use and is exquisitely responsive to external stimuli and nourishment. The converse is also true. Sensory deprivation may hinder recovery of function. The brain's apparent adaptability in recovering from brain injury may

occur according to physiological theory using spare capacity and reorganization, redundancy, response at a cellular level and environmental effects. The basis of coma arousal therapy lies in the frequency, intensity and duration of environmental stimuli that the patient receives. Sensory stimuli are essential factors in stimulating the ascending reticular activating system (RAS), the consciousness center, to maintain consciousness. Repetitive stimulation of intermediate thalamic nuclei, evokes waves of activity which propagate diffusely over the cortex. These are called 'recruiting responses' because they become progressively larger as stimulation is repeated. Such responses are blocked when brainstem reticular formation is thrown in to activity to produce an arousal reaction, suggesting that both phenomenon are mediated by same thalamo-cortical pathways. Walsh confirmed that the brain increases in both dimension and weight in a stimulus rich environment. In the work of Finger and Stan, brain injured patients exposed to a wide variety of stimulating experiences were found to develop an extensive functional neuronal circuitry that was lacking in restricted subjects. Sensory stimulation in comatose patients is directed to reticular system which has a much higher threshold than other systems in the body. Sensory stimulation lowers the threshold and thereby decreases the deprivation. Unconscious patients have short potential reactivity periods, hence the stimuli are given for very

short periods of time and efforts are made to avoid overstimulation.

CONCLUSION

Thus we conclude that early Modified Intense Multisensory Stimulation improves Glasgow Coma Score in children with non-traumatic acute neurological insult. However we could not follow these children till their complete recovery. Further study can be conducted for observing longterm effects of MIMS in children with coma due to non traumatic causes.

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