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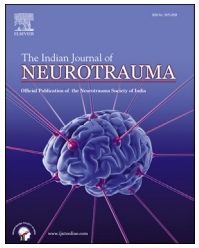

Original Article

Traumatic head injury: Early intervention by coma arousal therapy

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ABSTRACT

Objective: To find out efficacy and benefits of early intervention of Coma Arousal Therapy on patients with low GCS after sustaining Traumatic Head Injury.
Method: A total of 60 patients with Traumatic Head Injury were randomly selected. Both experimental group and control group had 30 patients each. Patients in experimental group (Group A) were given Coma Arousal Therapy while those in control group (Group B) did not receive any coma arousal therapy. Coma Recovery Scale (CRS) was assessed before and after 1 week and 2 weeks of protocol.
Results: The independent *t*-test was used for 'between the group' data analysis. Repeated measure ANOVA and Post hoc paired *t*-test were used for 'within the group' analysis. Group A, mean of CRS on 1st, 7th and 14th day of Coma Arousal Therapy was 2.05(±1.02), 4.78(±1.14) and 8.66(±1.36) respectively and for Group B was 2.06(±1.01), 2.87(±1.07) and 4.63(±2.12) respectively, which showed statistically significant improvement ($p < 0.5$). When compared between the groups, experimental group showed significant improvement.
Conclusion: The result of this study shows that Coma Arousal Therapy has significant effect on CRS in Traumatic Head Injury Patients when compared to the patients who did not receive Coma Arousal Therapy.

1. Introduction

Traumatic brain injury (TBI) may result in significant impairment of an individual's functioning—physical, cognitive, and psychosocial. TBI is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death and disability by the year 2020.[1] It is the most common cause of death in trauma victims accounting for about half of deaths at the accident site.[2] TBI is a leading cause of mortality, morbidity, and socioeconomic losses in India.[3]

One of the main consequences of head injury is coma. Davis and White concluded that patients in coma experience

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Fig. 1 – Kinesthetic sensation on upper limb.

Fig. 2 – Kinesthetic sensation on lower limb.

Fig. 3 – Tactile sensation with cotton cloth.

Fig. 4 – Tactile sensation with velvet cloth.

Fig. 5 – Auditory sensation with ringing bell.

Fig. 6 – Visual sensation with bright object.

sensory deprivation due to decrease in the ability to respond to internal and external stimuli and increase in threshold of activation of the reticular activating system. A controlled higher stimulation thus is required to generate Action potential in reticular neurons to increase cortical activity.[4] The undamaged axons may actually send out collateral connections, called collateral spouting, which assists in reorganizing the brain's activity.[5]

The study aims to find out the improvement in score of Coma Recovery Scale and to compare the scores of Coma Recovery Scale in patients receiving Coma arousal therapy and the patients not receiving coma arousal therapy.

2. Materials and methods

The study design was experimental in nature. Total 60 patients were randomly assigned (computer randomization)

Table 1 – Comparison of coma recovery scale between Group A and Group B.

Variables		Group A mean ± SD	Group B mean ± SD	t-value	Level of sig.
CRS	Day 1	2.055 ± 1.02	2.06 ± 1.01	0.670	0.501
	Day 7	4.786 ± 1.14	2.87 ± 1.07	4.504	0.0001
	Day 14	8.660 ± 1.36	4.633 ± 2.12	6.677	0.0001

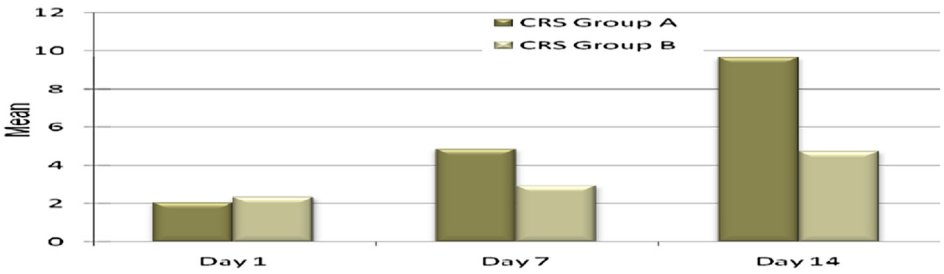

Fig. 7 – Comparison of CRS between Group A and Group B.

through to group A (Experimental Group) and group B (Control Group) 30 patients in each group. Selection criteria for patients was:

Inclusion criteria: (1) Traumatic brain injury, (2) GCS < 8, (3) 72 h after Trauma.

Exclusion criteria: (1) Medically unstable patients, (2) Patients on ventilation, (3) Pediatric Patients (4) Medical causes of low GCS.

Written consent forms were taken from the relative of patients and the stimulation therapy was given using a coma kit, which was prepared by locally available and easily affordable materials. Four senses (kinesthetic, visual, tactile and auditory senses) were stimulated twice a day for 2 weeks. The Coma recovery scale was measured on day 1, day 7 and day 14.

2.1. *Procedure for Coma Arousal Therapy*[6]

2.1.1. *Kinesthetic stimulation*

This was performed either on bed or on wheelchair, one extremity at a time. Each movement was done 2 times, allowing 1 min to respond.

2.1.2. *Lying on bed*

A. Movement of arms – patient's arm was supported at the elbow and hand. And then arm was slowly moved above the head as far as it go. Then it was held for 3 s then arm was lowered, keeping the elbow as straight as possible (Fig. 1).
B. Movement of legs – Patient's leg was supported at the knee and ankle, and was slowly bent toward the chest as

Table 2 – Comparison of auditory score between Group A and Group B.

CRS – Auditory		Mean ± SD	*t*-value	Level of sig.
1st Day	Group A	0 ± 0	0.000	1.000
	Group B	0 ± 0		NS
7th Day	Group A	0.5 ± 0.6	2.278	0.031
	Group B	0.060 ± 0.20		S
14th Day	Group A	1.666 ± 0.48	6.503	0.0001
	Group B	0.303 ± 0.60		S

NS: Non-significant; S: Significant.

Table 3 – Comparison of visual score between Group A and Group B.

CRS – Visual		Mean ± SD	*t*-value	Level of sig.
1st Day	Group A	0 ± 0	0.000	1.000
	Group B	0 ± 0		NS
7th Day	Group A	0.206 ± 0.36	2.240	0.031
	Group B	0 ± 0		S
14th Day	Group A	1.703 ± 0.50	6.30	0.001
	Group B	0.303 ± 0.51		S

NS: Non-significant; S: Significant.

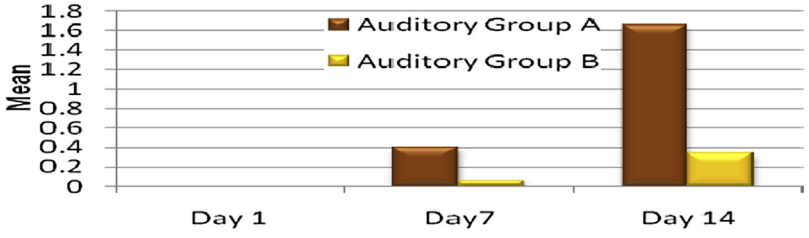

Fig. 8 – Comparison of auditory score between Group A and Group B.

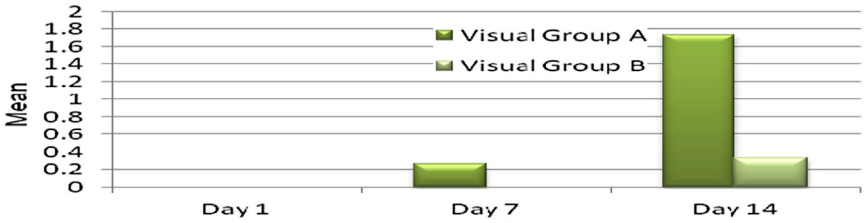

Fig. 9 – Comparison of visual score between Group A and Group B.

far as possible, held for 3 s and then lowered down, attempting to straighten the knee (Fig. 2).

C. Movement of head – Head was turned side to side, stretching as far as it could go.

D. Patient's knees were flexed, placing the feet flat on the bed and then laterally rotated keeping the knees together, held for 3 s in each position.

2.1.3. *Tactile stimulation*

Stimulus was presented for 5 s, twice, with a 3 s break between each stimulus. It was repeated to right and then, left upper extremities; then right and left lower extremities. Materials used were brush, various cloth textures, sandpapers, cotton ball (Figs. 3 and 4).

2.1.4. *Auditory stimulation*

Different stimuli were used in sequence. Each stimulus was presented for 5–10 s, twice, with a 3 s break, on right side and then on left side. Materials used were ring bell, familiar voices, and religious chants using ear pieces of ipod (Fig. 5).

2.1.5. *Visual stimulation*

Stimulus was presented for 5 s, twice, with a 3 s break between each stimulus in front outer, inner upper and lower quadrant/field of vision. Materials used were, brightly colored block, familiar photo, functional object (Fig. 6).

2.2. *Statistical analysis*

Statistics were performed by using SPSS 15. Results were calculated by using p value <0.05. The t-test was used to compare age between the two groups. Unpaired t-test was used to compare CRS between the two groups. Repeated measure ANOVA and Post hoc paired t-test were applied to determine the differences in the value of CRS after the treatment for within group analysis.

Table 4 – Comparison of motor score between Group A and Group B.

CRS – Motor		Mean ± SD	t-value	Level of sig.
1st Day	Group A	1 ± 0.45	1.000	0.226
	Group B	1.206 ± 0.60		NS
7th Day	Group A	1.743 ± 0.80	1.004	0.262
	Group B	1.503 ± 0.80		NS
14th Day	Group A	2.0 ± 0.50	2.602	0.001
	Group B	2 ± 1		S

NS: Non-significant S: Significant.

Table 5 – Comparison of oromotor score between Group A and Group B.

CRS – Oromotor		Mean ± SD	t-value	Level of sig.
1st Day	Group A	0.56 ± 0.46	1.286	0.206
	Group B	0.80 ± 0.36		NS
7th Day	Group A	1 ± 0	1.407	0.156
	Group B	0.80 ± 0.30		NS
14th Day	Group A	1 ± 0	1	0.326
	Group B	0.930 ± 0.20		NS

NS: Non-significant; S: Significant.

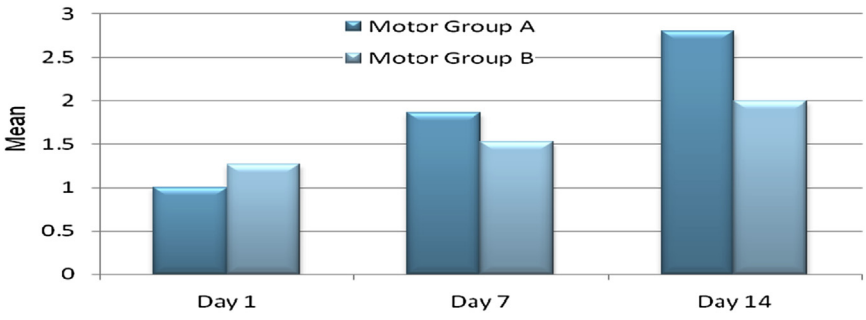

Fig. 10 – Comparison of motor score between Group A and Group B.

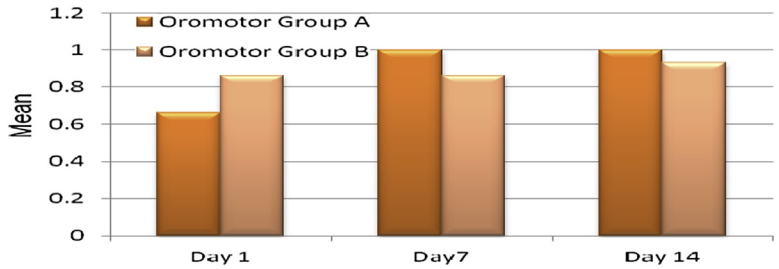

Fig. 11 – Comparison of oromotor score between Group A and Group B.

3. Results

A total 60 patients were taken for the study. Among these, 30 patients received Coma Arousal Therapy along with upper limb and lower limb passive movements and chest physiotherapy. Whereas 30 patients received only upper limb and lower limb passive movements and chest physiotherapy. The demographic characteristics of the study showed no significant difference between Group A and Group B, similar with respect to age and mean of variable CRS before starting the treatment.

3.1. *Comparison of Group A and Group B*

3.1.1. CRS

There was significant improvement in CRS in Group A patients at 1st and 2nd week observation. CRS improved from 2.05 ± 1.02 to 4.78 ± 1.14 to 8.60 ± 1.36 at end of 1st and 2nd week respectively, whereas CRS in Group B was 206 ± 1.10 and 4.63 ± 2.12 at the end of 2nd week (Table 1, Fig. 7).

3.1.2. *Auditory score*

On the 1st day before the treatment: Group A (0.00 ± 0.00), Group B (0.00 ± 0.00). It showed non-significant difference between both the groups. On 7th day of treatment, there was significant improvement in Group A (0.5 ± 0.6) as compared to Group B (0.06 ± 0.20). After 14th day there was further improvement in Group A as compared to Group B (Table 2, Fig. 8).

3.1.3. *Visual score*

On the 1st day before the treatment, there was no no difference between both the groups, but at 7th day of treatment, there was improvement in Group A (0.20 ± 0.36), as compared to Group B (0.00 ± 0.00). After 14th day of treatment there was

Table 6 – Comparison of communication score between Group A and Group B.

CRS – Communication		Mean ± SD	*t*-value	Level of sig.
1st Day	Group A	0.06 ± 0.26	1	0.335
	Group B	0 ± 0		NS
7th Day	Group A	0.4 ± 0.6	3.056	0.004
	Group B	0 ± 0		S
14th Day	Group A	0.80 ± 0.36	4.026	0.0004
	Group B	0.260 ± 0.46		S

NS: Non-significant; S: Significant.

Table 7 – Comparison of CSR–arousal score between Group A and Group B.

CSR – Arousal		Mean ± SD	*t*-value	Level of sig.
1st Day	Group A	0.336 ± 0.40	0.808	0.426
	Group B	0.20 ± 0.41		NS
7th Day	Group A	0.93 ± 0.26	3.132	0.004
	Group B	0.460 ± 0.50		S
14th Day	Group A	1.7 ± 0.56	3.770	0.006
	Group B	0.930 ± 0.40		S

NS: Non-significant; S: significant.

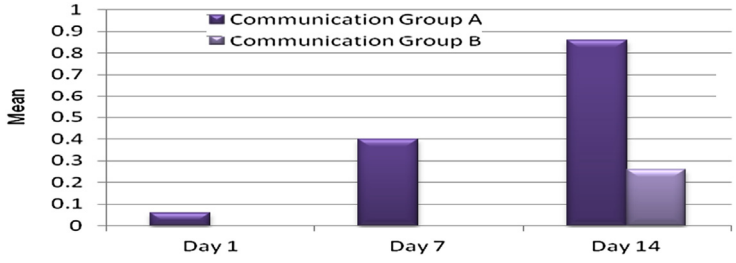

Fig. 12 – Comparison of communication score between Group A and Group B.

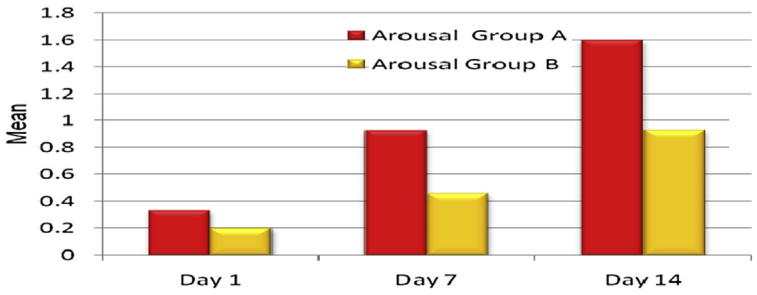

Fig. 13 – Comparison of arousal score between Group A and Group B.

further improvement in Group A as compared to Group B (Table 3, Fig. 9).

3.1.4. *Motor score*

Improved from 1.74 ± 0.80 to 2.0 ± 0.50 at 1st and 2nd week, respectively in Group A. This change was not significant in Group B (Table 4, Fig. 10).

3.1.5. *Oromotor score*

On 1st day was Group A (0.56 ± 0.46), Group B (0.80 ± 0.36). It showed non-significant difference between both the groups at 7th day of treatment Group A (1.00 ± 0.00), Group B (0.80 ± 0.30) and at 14th day of treatment, Group A (1.00 ± 0.00), Group B (0.93 ± 0.20) (Table 5, Fig. 11).

3.1.6. *Communication score*

On the 1st day before the treatment: Group A (0.06 ± 0.26), Group B (0.00 ± 0.00). After 7th day of treatment Group A (0.40 ± 0.60), showed improvement as compared to Group B. After 14th day of treatment there was further improvement in Group A (0.80 ± 0.36) as compared to Group B (0.26 ± 0.46). It showed significant improvement in Group A as compared to Group B (Table 6, Fig. 12).

3.1.7. *Arousal score*

On the 1st day before the treatment were Group A (0.33 ± 0.40), Group B (0.20 ± 0.41). After 7th day of treatment Group A (0.93 ± 0.26) had better scores as compared to Group B (0.46 ± 0.50). After 14th day of treatment, Group A (1.70 ± 0.56) patients had statistically better scores than Group B (0.93 ± 0.40) (Table 7, Fig. 13).

4. Discussion

The results of this study suggest that implementation of Coma Arousal Therapy for 2 weeks can enhance consciousness recovery in traumatic head injury patients with low GCS. Our results confirm previous observations that sensory stimulation implemented at an early stage of trauma is beneficial to brain-injured patients (Kater, 1989; Mitchell et al, 1990; Sosnowski and Ustik, 1994).[5] The rationale is that Coma Arousal Therapy of sufficient frequency, intensity and duration improves GCS by neuronal organization, increased dendritic branching, increased numbers of dendritic spines; stimulating the reticular activating system and increasing the level of cognitive function.

5. Conclusion

The result of this study shows that Coma Arousal Therapy has significant effect on CRS when compared to patients who did not receive Coma Arousal Therapy. Hence, Null Hypothesis is rejected and Alternate Hypothesis is accepted.

Conflicts of interest

All authors have none to declare.

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