

Effect of Stimulation in Coma

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Objective: To find out efficacy and benefits of early starting of stimulation therapy in coma patients. **Design:** Randomized controlled trial. **Method:** Sixty children admitted to the Department of Pediatrics, having coma due to non-traumatic neurological insult were randomly selected. Both study and control groups had 30 patients each. Children in the study group were given stimulation therapy while those in control group received no stimulation. The level of consciousness was assessed before and two weeks after giving stimulation therapy. **Results:** Improvement in level of consciousness was better in study group as compared to control after two weeks of stimulation therapy. **Conclusion:** Stimulation therapy was found to be highly effective in coma patients.

Keywords: Coma, Stimulation therapy.

COMA is a state of loss of consciousness with decreased arousability and responsiveness to usual visual, auditory and tactile stimuli. For children in coma survival alone is not enough but survival with complete neurological recovery in shortest possible time is important(1).

In brain more frequently used pathways are preserved whereas less frequently used pathways disappear(2). The brain has spare capacity and ability to reorganize its functions whenever there is damage to one part of brain the spare or non active areas assume the functions of damaged area by a process of reorganization. The brain also has capacity to duplicate neuronal pathway in case existing pathway is damaged. The undamaged neurons send out new connections in an attempt to compensate for functions of damaged neurons. There is also evidence that

performance of neurons is directly proportional to environmental stimulation(1) Children in coma though have decreased response to stimuli, but still they are aware of many stimuli presented to them, increasing force of stimuli makes them to respond. These are the principles behind giving stimulation therapy.

Patients receiving indoor treatment due to various causes of coma continue to receive treatment according to the specific cause or most likely cause, but special attempts are not made to bring them out of coma. As a result it may happen that the causative disease is cured but coma may persist(3). The present study was undertaken with the aim to find out efficacy of stimulation of brain along with treatment of underlying disease and whether stimulation started early is more beneficial than if stimulation is delayed.

Subjects and Methods

The study was carried out in 60 children admitted to department of pediatrics, G.M. Hospital and S.S. Medical College Rewa from August 2003 to September 2004. In this prospective study cases were assigned to Study and Control groups randomly. Children in coma due to non-traumatic causes were included while those in coma due to traumatic causes were excluded. The stimulation therapy was initiated as early as possible in study group after children were stable hemodynamically and according to other vital parameters respiratory function, temperature, convulsions and circulation.

The stimulation therapy was given using a coma kit, which was prepared by locally available and easily affordable material(4). Each of the six senses (visual, auditory, olfactory, gustatory, tactile and kinesthetic senses) were stimulated five times in a day with a resting period of 2 to 3 hours in between. Apart from stimulation therapy management was same in both study and control group. First time the stimulation was given by investigator herself, second time by the family members under supervision of investigators and subsequently same person provided regular stimulation.

For stimulation of various sensations, coma kit was made up of following items.

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| 1. Visual stimulation | Light of torch, bright colors and familiar faces. |
| 2. Auditory stimulation | Talking, Ring bells, Familiar voice. |
| 3. Olfactory stimulation | Scented sticks, spirit swab. |
| 4. Gustatory stimulation | Sugar and salt solution and orange juice. |
| 5. Tactile stimulation | Touch, massage without and with oil. |

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| 6. Kinesthetic stimulation | Rolling side to side and change of posture and full range of movements in limbs. |
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Before stimulation therapy complete clinical details *i.e.*, history and examination were recorded and relevant investigation done to identify cause and manage cases. The level of consciousness was assessed using Glasgow Coma Scale (GSS) and AVPU (A = the child is awake and alert, or V = responds to voice, or P = responds to pain *e.g.*, pinching or pulling frontal hair, or U = unconscious) scale before initiation of stimulation and two weeks after stimulation therapy.

Results

Total 60 patients were studied 30 in each Control and Study group. Most of the cases both in study and control group were boys and majority of them were in the age group of 1 to 5 years (*Table I*). Common causes of coma were pyogenic meningitis, cerebral malaria, tubercular meningitis, fulminating hepatic failure and others in decreasing order of frequency (*Table II*). The GCS score showed significant improvement after 2 weeks of stimulation therapy in study group while in control group GCS score remained almost unchanged and did not show any significant improvement (*Table III*).

Assessment of patients on AVPU scale revealed that improvement in level of consciousness after 2 weeks of stimulation in Study group was significant while in Control group there was no significant improvement in level of consciousness (*Table IV*).

Patients in study group in whom stimulation therapy started early (<5 days of onset) and inter mediate period (6 to 15 days) showed better improvement in comparison to those patients in whom stimulation therapy was started after 15 days of onset of coma (*Table V*).

TABLE I—*Distribution of Cases According to Age and Sex*

Age group	Study group		Control group		Total
	Male	Female	Male	Female	
2 months to 1 yr	3	—	3	1	7
1 to 5 yr	11	5	14	4	34
5 yrs onwards	7	4	5	3	19
Total	21	9	22	8	60

TABLE II—*Distribution of Cases According to Diagnosis*

Diagnosis	Study group		Control group	
	Number	%	Number	%
Pyogenic meningitis	16	53.3	14	46.7
Cerebral malaria	7	23.3	5	16.7
Tubercular meningitis	5	16.7	7	23.3
Fulminating hepatic failure	1	3.3	2	6.7
Miscellaneous	1	3.3	2	6.7
Total	30	100.0	30	100.0

TABLE III—*Glasgow Coma Scale Score at Admission and Two Weeks After*

Diagnosis		Study group		Control group	
		GCS on admission	GCS 2 weeks after	GCS on admission	GCS 2 weeks after
Pyogenic meningitis	Mean ± SD	8.13 ± 1.46	11.75 ± 2.54	7.07 ± 2.05	7.73 ± 2.09
	P value	0.0002		0.42	
Tubercular meningitis	Mean ± SD	5.0 ± 1.00	7.8 ± 2.95	6.71 ± 2.21	7.43 ± 2.23
	P value	0.09		0.6	
Cerebral malaria	Mean ± SD	6.4 ± 1.35	12.77 ± 2.98	7.4 ± 2.50	7.2 ± 2.50
	P value	0.002		0.83	
Fulminant hepatic failure	Mean ± SD	9.0	15.0	7.0 ± 1.14	6.5 ± 0.71
	P value			>0.99	
Miscellaneous	Mean ± SD	9.0	15.0	8.0 ± 2.82	8.0 ± 0.00

The statistical analysis was done according to Mann Whitney U Test of significance.

Discussion

Organs of various systems in body need rest for recovery from disease, where as nervous system needs stimulation devoid of stimulation it degenerates. It is also a common observation that patients in coma receive all types of care empirical, specific and supportive but hardly any thing is done actively to return him to normal consciousness. It is believed that recovery from disease will automatically lead to recovery of consciousness. This does happen but not always.

In this prospective and randomized study, 30 patients were each in control and study group. Both groups received similar empirical, specific and supportive treatment according to diagnosis. The patients in study group received stimulation to nervous system as soon as their vital parameters became stable. These children showed statistically

significant improvement in coma according to GCS and AVPU scale as compared to controls.

The authors have made extensive search of literature to find out similar studies of stimulation therapy of nervous system in comatose patients, in whom coma is caused by non traumatic medical causes but the literature is scant on this topic and most of studies of stimulation therapy are in coma due to head injury. In a study by Mitchell, *et al.*(4). Twelve patients of severe brain damage due to head injury were included and their GCS improved from 5.16 to 14 due to stimulation therapy(4). In another study by John, *et al.*(5) 13/31 patients of coma in study group had good to moderate recovery while only 42/135 patients in control group had good or moderate recovery.

Patients in coma initially require stronger stimuli, once they start responding lesser strong

TABLE IV—Distribution of Patients According to AVPU Scale After Two Weeks

AVPU scale	Study group No. of patients		Control group No. of patients	
	At admission	After two weeks	At admission	After two weeks
A =Alert	0	13	1	0
V = Responds to Voice	1	12	4	5
P = Responds to Pain	23	3	17	20
U = Unconscious	6	2	8	5

Chi square applied for comparison: Study $P < 0.001$; Control $P > 0.05$.

TABLE V—Improvement in GCS on the Basis of Day of Starting Stimulation Therapy in Study Group

Day of initiation of stimulation therapy	GCS score before stimulation			GCS score 2 weeks after stimulation		
	<5	6-10	11-15	<5	6-10	11-15
Group I 0-5 days	1	6	—	—	—	7
Group II 6-15 days	3	18	—	—	12	9
Group III >15 days	1	1	—	1	—	1

Key Messages

- Patients in coma given stimulation therapy by using locally available and lowcost materials show better recovery than similar group of patients treated without stimulation.
- Earlier the stimulation therapy started shorter is the time for recovery from coma.

stimuli are able to get response. Patients given stimulation therapy showed early recovery of consciousness then those without stimulation. The brain of unconscious children has not lost all the function, still it has lot of functioning areas. By selecting a variety of stimuli these areas can be stimulated, this will make the process of return of consciousness faster. Many patients who have capacity to recover may not recover for want for stimulation(4-7).

Aldridge, *et al.*(8) studied effect of music therapy in comatose patients and found that patients in coma respond by alteration in breathing, heart rate, blood pressure and EEG patterns. These changes establish the fact that patient in coma retain ability to perceive various stimuli and respond in a limited way.

We conclude that stimulation therapy can reduce the duration of non-traumatic coma in children. This type of stimulation therapy can be easily included in the existing clinical practice. The limitation of the study is a small sample size and shorter duration of follow up. A large sample size and longer duration of stimulation therapy and follow up shall be more informative.

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