Original Research Article

Role of modified Glasgow coma scale to predict outcome in nontraumatic coma

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INTRODUCTION

Coma refers to a state in which the patient is unable to arouse or respond to various stimuli and is completely unaware of self and surrounding. The term coma derives from the Greek word 'KOMA', which refers to deep sleep. The fundamental difference between sleep and coma is that sleeping person can be aroused with appropriate stimulus intensity and duration to a normal state of consciousness, while a comatose person cannot. Sleep is biologically active state with identifiable behavioural and electroencephalographic stages while coma is a state of reduced neuronal activity. Consciousness: refers to state of awareness of self and environment. Drowsiness: Is a state resembling normal sleepiness. Stimulation rouses the patient to a state of complete wakefulness and Co-operation, but he tends to sink into sleep again if stimulation ceases. Delirium: Is a state of confusion with excitement and hyperactivity patients are discriminated, fearful and irritable. Obtundation: Refers to mild to moderate reduction in alertness accompanied by decreased interest in the environment. Stupor: Left alone, the patient appears to be completely unconscious, but nevertheless may be restless. On vigorous stimulation he can be roused sufficiently to resist painful stimuli, or even for short period to respond to commands or to answer simple questions. No satisfactory Co-operation is obtained and as soon as stimulation ceases the patient revert to his original state. Coma is a state of unarousable psychologic unresponsive in which subjects lie with eyes closed and show no psychologically understandable response to external stimulus or inner need.

BACKGROUND

Non-traumatic coma in childhood is an important Paediatric emergency. Coma is recognised to be nonspecific sign with a wide potential differential diagnosis. These children make heavy demands on Paediatric intensive care unit and neuro rehabilitation resources. Neurologic outcome is often of foremost concern to parents and physicians. It may range from absence of impairment to severe disability or death. Aetiology of coma and clinical status at the time of presentation are likely predictors of outcome. A better understanding of outcome is essential to help improve the approach and to plan rational management of non-traumatic coma. There are very few studies on outcome of nontraumatic coma from developing countries including India. Therefore, in this study we have examined the role of modified Glasgow coma scale to predict the outcome in nontraumatic coma. The MGCS has been shown to have statistical correlation with a broad array of adverse neurologic outcomes, including brain injury and mortality. The MGCS score has been incorporated into numerous guidelines and assessment scores.

Studies Done So Far: Pushpa Chaturvedi and Manu Kishor *et al* in their prospective hospital-based study from Jan 1997 to Dec.1998 of 48 children who were admitted with fever and unconsciousness concluded that, overall mortality was 29.1% out of which 85% died within the 1st

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24 hours. Mortality was highest in the toddler age group and in patients with pyogenic meningitis. There was a significant association between death and MGCS scores on admission with a post-test probability for discharge being only 10% with a score of <5 and 99% with a score of >10 respectively. MGCS score on admission can be used to predict mortality in patients hospitalized with fever and unconsciousness. **P.C. Nayana Prabha, P. Nalini *et al*** did a prospective observational study from oct.1998 to March 2000 to assess the relationship between MGCS, its components and survival in 270 children with acute coma at JIPMER Pondicherry. In this study they found that intracranial infections viral encephalitis, pyogenic meningitis and tuberculous meningitis were the most common cause of coma (n=218, 80.7%) with viral encephalitis (n=115, 41.5%) forming the largest group. Metabolic disturbances (hepatic encephalopathy, dyselectrolytemia) contributed to 9.3% (n=25) of comatose children. Rest of the cases included encephalopathies i.e. enteric (n=10,2.7%), toxin induced (n=8, 2.96%) hypoxic ischemic (n=5, 1.85%) and hypertensive (n=4, 1.48%)., mortality was highest in the metabolic group (48%). The mortality rates in intracranial infections and encephalopathies were 26.6% and 30.5% respectively. In this study it has been noted that aetiology did not affect short term outcome and total MGCS score had a significant correlation with immediate outcome.

Assessment Of Coma: There is a continuum of altered consciousness and this can be subdivided depending on the degree of severity. Plum and Posner subdivided this continuum into clouding of consciousness, delirium, obtundation, stupor and coma. While specific definitions have been suggested for each of these states, they are not uniformly applied and easily confused. Thus, for clinical management and communication clinicians not to rely on single word descriptions of a patient with altered mental status. Instead, the patients state should be carefully described including: orientation, verbal output, eye opening and response to environmental stimuli. In the last 3 decades various scores have been used to assess the severity of coma and to predict its outcome. These include the Glasgow coma scale (GCS), James adaptation of Glasgow coma scale, the Simpson and Reilly scale, Children's Coma Scale, the Children's Orthopaedic Hospital and Medical Centre Scale. Among these the modified Glasgow coma scale (MGCS) in spite of its various drawbacks, has been widely used for assessing paediatric coma. Response to pain should be examined both with a supraocular pressure and nail bed pressure with a pencil. At initial presentation, it is preferable to err on the side of recording too low a score, as it is easier to withdraw treatment from a child who is improving than to resuscitate one, who deteriorates.

MATERIAL AND METHODS

The present study was carried out at PVPGH, tertiary care hospital over a period of 2 years.

Inclusion criteria – Any child (1 month to 12 years old)

1) From pediatric ward and PICU with MGCS score less than 12 for more than 6 hours.
2) First 100 patients were included.

The study was conducted in the following manner –

1) A detailed clinical history was taken in each case.
2) All the patients were examined thoroughly including special attention to CNS.
3) Daily assessment of patient's progress and complication during course of illness monitored.
4) All the possible investigations like hematological, biological, microbiological, CSF, radiological, CT scan and EEG were performed as and when required.

Modified Glasgow coma scale score were assessed on admission and repeated in each case after 6 hours, 48 hours, 72 hours and 7th day of admission.

Modified Glasgow coma scale (pain as nail bed pressure with pencil, score best response):

1. Eye Opening

Score	>1 year	<1 year
4	Spontaneously	Spontaneously
3	To verbal command	To shout
2	To pain	To pain
1	No response	No response

2. Best Motor Response

Score	>1 year	<1 year
6	Obeys	Spontaneous
5	Localizes pain	Localizes pain
4	Flexion withdrawal	Flexion withdrawal
3	Flexion abnormal	Flexion abnormal
2	Extension	Extension
1	No response	No response

3. Best Verbal Response

Score	>5 years	2-5 years	<2 years
5	Oriented and converses	Appropriate words and phrases	Smiles, cries appropriately
4	Disoriented and converses	Inappropriate words	Cries, consolable
3	Inappropriate words	Persistent cries and smiles	Persistent inappropriate crying or screaming
2	Incomprehensible sounds	Grunts	Grunts, agitated or restless
1	No response	No response	No response

The minimal MGCS score is 3 and the maximum score is 15. The patient with MGCS score of 8 or less may require aggressive management, including mechanical ventilation and intracranial pressure monitoring.

Management

A. To normalize the respiration and circulation: The basics of neurological stabilization including the ABC's of resuscitation and maintenance of adequate oxygenation done in every patient. The decision to intubate the trachea and institute mechanical ventilation was determined by the need to control the airway. Circulation was normalized, with the aim of optimizing perfusion to all tissues. If after appropriate fluid resuscitation the patient still has poor perfusion, inotropic agents like dopamine to enhance cardiac output was used. Once the patient's cardiac output was stabilized, modest fluid restriction done to avoid fluid overload and attendant hypervolemia.

B. To reduce raised intracranial pressure:

- Endotracheal intubation and monitoring of the blood gases to ensure appropriate oxygenation and ventilation to keep $PaCO_2$ at 30-35mmHg done as and when required.
- Ventriculostomy has been placed for periodic removal of CSF to reduce ICP.
  Diuretics like mannitol and frusemide and intravenous steroids were used as and when required.

a) To control seizures – injectable diazepam, phenobarbital and phenytoin were used. Continuous intravenous drip of midazolam used in refractory seizures.

b) Treatment of infection was done with broad spectrum antibiotics initially and after culture reports according to sensitivity pattern.

c) Correction of acid base and electrolyte imbalance done.

d) Specific antidotes were used as and when required.

Data was collected on 100 printed proformas and later tabulated on computer software. Data was analyzed and interpreted in relevance to the aim of study.

RESULTS

Table 1: Duration of symptoms before hospitalization in nontraumatic coma.

Duration (Days)	CNS infections (n=54)		Epilepsy (n=13)		Metabolic Disorder (n=18)		Hypoxic ischemic (n=07)		Intoxication (n=08)		Total (n=100)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-3	13	24.07	11	84.61	05	27.77	01	14.28	08	100	38	38.00
4-7	25	46.29	02	15.38	03	16.66	05	71.42	-	-	35	35.00
8-14	11	20.37	-	-	05	27.77	-	-	-	-	16	16.00
15-21	03	5.55	-	-	04	22.22	01	14.28	-	-	8	8.00
>21	02	3.70	-	-	01	5.55	-	-	-	-	3	3.00
Total	54	100	13	100	18	100	07		08	100	100	100

In majority of cases of CNS infections and hypoxic-ischemic encephalopathy, duration of illness prior to hospitalization was between 4 to 7 days while that of epilepsy and intoxication within 3 days.

Table 2: MGCS scores on admission and follow up.

MGCS score	On admission	6 hours	24 hours	48 hours	72 hours
<5	13	17	05	05	02
5-7	45	36	18	06	03
8-10	33	32	21	11	05
>10	09	15	38	53	59
Expired	-	-	18	25	31

The majority of cases of nontraumatic coma admitted had MGCS score between 5 to 7 while at 48 hours of admission maximum number of cases had MGCS score >10.

Table 3: stratum specific likelihood ratio for positive predictive for predicting Deaths with Different cut-offs of the aggregate MGCS score on admission. The positive predictive value for death was maximum for MGCS score <5 on admission while it was decreased as the score on admission increased.

Score on admission	Total	Died	Discharged	Positive predictive value for deaths
<5	13	12	01	0.92
5-7	45	20	25	0.44
8-10	33	03	30	0.09
>10	09	-	09	0.00
Total	100	35	65	

DISCUSSION

Presenting symptoms: Predominant presenting symptoms in the present study group were altered sensorium, convulsion, fever, vomiting and irritability as shown in table no. Altered level of sensorium was the commonest symptoms in all groups and noted in all cases (100%). In CNS infections, fever was noted in 45% cases (83.33%). It was mild to moderate grade. Fever was not present in 9 cases (16.67%). Out of them, 5 cases had received antipyretic while 2 cases were presented in the state of shock had cold extremities due to poor perfusion. Convulsion were noted in 42 cases (77.77%). Out of them 35 cases (83.33%) had generalised tonic-clonic seizures and remaining 7 cases (16.66%) had focal convulsions. Vomiting in 22 cases (40.75%), irritability in 20 cases (37.03%), lethargy and cough in 15 cases (27.77%) each and headache in 12 cases (22.22%) were noted. In epilepsy, convulsions were present in all the cases while fever was noted in 7 cases (53.84%). Other predominant symptoms were vomiting, 4 cases (30.76%), irritability and lethargy 3 cases each (23.07%). In metabolic disorders vomiting was the predominant symptom noted in 10 cases (55.55%). Other common symptoms were fever in 9 cases (50%), irritability in 8 cases (44.44%), convulsion in 6 cases (33.33%) and behavioural change in 5 cases (27.77%) noted. Yellowish discoloration of urine and eyes was present in 10 cases (55.55%). All these cases belonged to hepatic encephalopathy. In hypoxic-ischemic encephalopathy, fever and cough were the predominant symptoms noted in 6 cases (87.71%) each. Convulsions were present in 4 cases (57.14%) while irritability in 3 cases (42.85%), lethargy in 2 cases (28.57%), and headache in 1 case (14.28%) was noted. In intoxication fever was noted in 4 cases (50%) while convulsions and vomiting were noted in 3 cases (37.5%) each. Wong CP *et al* in his study had noted altered level of sensorium convulsions, vomiting, fever and lethargy as the commonest symptoms in the present study. But there appears great disparity on the % of cases presenting with this symptom as shown in the following table.

Symptoms	Present study (n=100)		Wong CP *et al* (n=216)	
	No	%	No	%
Altered sensorium	100	100	78	36.11
Fever	50	50	55	25.46
Convulsion	68	68	55	25.46
Vomiting	39	39	60	27.77
Lethargy	27	27	37	17.12
Irritability	36	36	22	10.18
Headache	13	13	28	12.96

This disparity in percentage of patients presenting with above symptoms between present study and Wong CP *et al* might be due that patients were brought in advanced stages of coma in the present study. This happened due to majority of cases in the present study belonged to low socioeconomic status and were illiterate.

Modified Glasgow Coma Scale Score: Table shows number of patients at various MGCS scores on admission and on follow up. On admission majority of the patients had MGCS score between 5 to 7 while at 72 hours of admission had> 10.45 cases (i.e. 45%) on admission had MGCS score between 5 to 7 while 13 cases (13%) 33 cases (33%) and 9 cases (9%) had < 5,8 to 10 and >10 respectively. At 6 hours also majority (36%) of cases had MGCS score between 5 to 7 while 17 cases (17%), 32 cases (32%) and 15 cases (15%) had, 5,8 to 10 and >10 respectively. By 24 hours of admission 18 patients (18%) were died. 38 patients (38%) had MGCS score more than 10. Only 5 patients (5%) had score < 5 while 18 patients (18%) and 21 patients (21%) had 5-7 and 8 to 10 respectively. By 48 hours, 25 patients (25%) were dead. While 53 patients (53%) had MGCS score more than 10. 5 patients (5%) had score < 5 while 6 patients (6%) and 11 patients (11%) had 5 to 7 and 8 to 10 respectively. 31 patients (31%) died up to 72 hours of admission. At 72 hours, 59 patients (59%) had MGCS score more than 10 while 2 patients (2%), 3 patients (3%) and 5 patients (5%) had <5, 5 to 7 and 8 to

10 respectively. Only 4 patients (4%) died after 72 hours of admission. Out of them one who was diagnosed as viral encephalitis with AIDS with MGCS score 6 at 72 hours died on 9th day of admission. Remaining 3 patients with MGCS score 3,6 and 5 at 72 hours died on 4th,5th, and 6th day of admission respectively.

These findings of the present study are comparable with the study of Pushpa Chaturvedi *et al* as shown in following table.

MGCS Score	On admission		At 24 hours		At 48 hours		At 72 hours	
	Present Study	Pushpa C. *et al.*	Present Study	Pushpa C. *et al.*	Present study	Pushpa C. *et al.*	Present study	Pushpa c. *et al.*
<5	13	18.75	5	6.25	5	2.08	2	4.16
5 to 7	45	45.83	18	18.75	6	14.58	3	6.25
8 to 10	33	18.75	21	6.25	11	6.25	5	8.33
>10	9	16.67	38	43.75	53	50	59	54.16
Expired	-		18	25	25	27.08	31	27.08

In both the study majority of patients on admission had MGCS score between 5 to 7 while at 24-hour, 48 hour and 72 hour more than 10. In Pushpa Chaturvedi *et al* study 1 patient (2.08%) died after 72 hours while in present study 4 patients (4%) died after 72 hours. In P.C. Nayana Prabha *et al* study also a low total MGCS score was found to be associated with adverse short-term outcome i.e. death. The likelihood of death in patients with MGCS less than 8 was much higher than when the MGCS was >8.

MGCS Score on admission and outcome: Table no shows MGCS score on admission of the patients and their outcome in the form of death and positive predictive value for deaths. On admission 13 patients were having MGCS score <5. Out of them 12 (92.30%) were dead and only one (7.70%) survived. This shows positive predictive value for death was 0.92 for score <5 on admission. 45 patients had score 5 to 7 on admission. Out of them 20 (44.44%) died while 25 (55.56%) discharged. Positive predictive value for death was 0.44 for score 5 to 7. Only 3 patients (09.09%) died among 33 patients who had score 8 to 10. No death occurred when MGCS score was more than 10. The findings of the present study are consistent with the study of Pushpa Chaturvedi *et al* as shown in following table.

MGCS on admission	Total no of patients		Died		Discharged		Positive predictive value for death	
	Present study	Pushpa C. *et al.*	Present study	Pushpa C. *et al.*	Present study	Pushpa C. *et al.*	Present study	Pushpa C. *et al.*
<5	13	18.75	92.3	88.88	7.69	11.12	0.92	0.88
5-7	45	41.66	44.4	25.0	45.6	75.0	0.44	0.25
8-10	33	22.91	9.09	9.09	90.9	90.9	0.09	0.09
>10	9	16.67	-	-	100	100	0.00	0.00

In both the studies positive predictive value for death is nearly same for each range of MGCS score on admission.

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