



Paediatrics

EFFECTIVENESS OF MODIFIED GLASGOW COMA SCALE (MGCS) IN COMBINATION WITH BRAINSTEM REFLEXES ON SURVIVAL OUTCOME PREDICTION IN CHILDREN WITH NON-TRAUMATIC COMA

Shaji SM*

Associate Professor, Department of Paediatrics, Sree Gokulam Medical College and Research Foundation, Trivandrum, Kerala, India *Corresponding Author

Leya Sara

Junior Resident, Department of Paediatrics, Sree Gokulam Medical College and Research Foundation, Trivandrum, Kerala, India

Benny PV

Professor, Department of Community Medicine, Sree Gokulam Medical College and Research Foundation, Trivandrum, Kerala, India

ABSTRACT **BACKGROUND:** The Modified Glasgow Coma Scale (GCS) was primarily developed to depict the level of consciousness in patients with head injuries. This scale was created to aid the assessment and grading of brain dysfunction severity and outcome, and also widely used and accepted prognostic indicator for non-traumatic altered consciousness. This study is to analyze the effectiveness of Modified Glasgow Coma Scale (MGCS) in combination with brainstem reflex assessment score in predicting the survival outcome in children with non traumatic coma.

MATERIALS AND METHODS: A hospital based descriptive study conducted among children aged 5 months to 15 years, admitted in paediatric intensive care unit (PICU) of a tertiary care teaching hospital with non-traumatic coma during the period of January 2010 to January 2012.

RESULTS: Individual components of MGCS were analysed and found that low individual scores and the total score of less than eight were associated with poor out come in terms of death, which has got a significant association ($P < 0.001$). The brainstem reflex score of more than 2 was found to be predictive of better outcome ($P = < 0.001$).

CONCLUSION: The Modified Glasgow Coma Scale (MGCS) and Brain stem reflexes score are simple, easily applied at bed side, but both having limitations. The application of both these scores simultaneously can help in decision making in management and timely referral.

KEYWORDS : MGCS, GCS, Brainstem reflexes, Coma, Stupor.

BACKGROUND

Acute non-traumatic coma accounts for 10-15% of all hospital admissions and is associated with significant mortality (1). Infections are the commonest cause of non-traumatic coma and other causes include toxic, metabolic, status epilepticus and idiopathic. Assessment of the severity of coma is absolutely essential on predicting the prognosis of a patient in coma. In spite of its various drawbacks MGCS has been widely used for the assessment of pediatric coma, though only few studies are available to support its use in pediatric coma as a whole. There are three main sources of possible interference with assessment of one or more component of the scale. Pre-existing factors like language or cultural differences, Intellectual or neurological deficit, hearing and speech impediment, effects of current treatment like intubation or tracheostomy and sedation or paralysis.

The Glasgow Coma Scale (GCS) permits 120 possible mathematical combinations of eye, verbal and motor scores. Out of these only 15 are clinically valid and useful in the assessment of altered consciousness (2). It is a Here is the importance of a practical scale with high validity and good sensitivity to changes in level of consciousness. The three components that make up the GCS – motor, eye-opening and verbal; though one or more may not be testable in clinical practice, limiting the usefulness of the aggregate score. Despite these limitations, the GCS continues to be universally accepted (3).

The GCS seems straight forward. It is simply the sum of three added values that describe a patient's motor (1-6), Verbal (1-5) and Eye (1-4) level of response to speech or pain. Not only used to describe the individual trauma of patients, but also used as a component of several other outcome prediction scores (4). Modified Glasgow Coma Scale (MGCS) score can be assessed at the bedside, requires only the knowledge and clinical acumen for application (5).

Brainstem reflexes scoring can also help in determining the prognosis and severity of Coma. In which key factors are Respiratory pattern, pupils, corneal reflex and Doll's eye movement. A score of total 4 is taken and a score above 2 is predictive of better outcome.

In a prospective study, the authors have therefore examined the etiology, clinical signs and severity of non-traumatic coma in children with a view to define predictors of outcome. This study is to evaluate the relation between Modified Glasgow coma scale and Brainstem

reflexes in predicting survival and outcome in children with non-traumatic coma.

MATERIALS AND METHODS

This study was a hospital based descriptive study among 100 consecutive children belonging to the age group of 05 months to 15 years, with non-traumatic coma admitted in paediatric intensive care unit (PICU) of a tertiary care teaching hospital, during the period from January 2010 to January 2012. Those children with coma secondary to trauma, children with developmental delay and any other pre existing neurological illness were excluded from this study. All children belonging to the age group of 05 months to 15 years, admitted with non -traumatic coma were evaluated with appropriate history and relevant investigations as per the clinical suspicion. Biochemical investigations like complete blood count, urine analysis, blood sugar, serum electrolytes, serum ammonia, calcium, arterial blood gas analysis, serology, CSF analysis in suspected infection, toxic and metabolic screening, and imaging studies were performed if required.

Simultaneously all these patients underwent focused and serial neurological examination as per the standard protocol (MGCS and Brainstem reflexes at 6 hourly intervals from the time of admission to 72 hours after admission and findings were recorded in proforma). The lowest score of MGCS and worst Brainstem reflexes score (based on the number of reflexes present) were used for analysis. Data was entered in Microsoft excel, and analysis was done by using SPSS software. Written ethical consent was obtained from institution ethical committee before the commencement of the study.

RESULTS

The following observations were tabulated on completion of the study Male female ratio noticed were 57: 43.

39% were within the group of 5 to 9 years and 38% 1 to 4 years (Table 1).

Table 1: Age distribution of cases

Age group (Years)	Number of cases
< 1	9
1-4	38
5-9	39
10-14	14
Total	100

In total, 79% of the cases belonged to the age group of 1 to 9 years.

Most common presenting symptoms were fever, 86% of the cases and convulsion, in 73% of the cases (Table 2).

Table 2: Presenting symptoms

Presenting symptoms	Number of cases
Fever	86
Headache	25
Vomiting	02
Convulsion	73
Rashes	16
Ingestion of toxins	
Kerosene	04
OP Poison	04
Others	
Icterus	02
Animal bite	02
Edema	01

Assessment based on the level of consciousness, 96% of cases were found to be either stuporous or comatose (Table 3). 55% were in coma and 41% were in stuporous stage.

Table 3: Level of consciousness

Level of consciousness	Number of cases
Drowsy	04
Stupor	41
Coma	55
Total	100

The MGCS score < 8 was associated with poor outcome in terms of death. 90% cases with MGCS score of eight survived, and 90.9% succumbed to death when MGCS score was six. 100% of the children with MGCS score of nine survived in this study.

Table 4: Total MGCS score and outcome

Total score	No. of children	Survived	Death
13	02	2 (100)	0
12	01	1 (100)	0
11	06	6 (100)	0
10	11	11 (100)	0
9	20	20 (100)	0
8	20	18 (90)	2 (10)
7	12	7 (58.3)	5 (41.7)
6	11	1 (9.1)	10 (90.9)
5	8	0	8 (100)
4	5	0	5 (100)
3	4	2 (50)	2 (50)

In order to identify the factors that independently predicted the outcome, individual components of MGCS were analyzed with individual scores. It showed that low individual scores were associated with adverse outcome (death in acute non-traumatic coma) (Table 5). In 81.8% of the deaths, the ocular response was one. 100% of the cases with ocular response score of 3 survived. There was a significant association between increase in ocular response and survival rate (p=<0.01). High survival rate was found in motor response of 2 or more. Highly significant association was found in motor response and outcome (p=<0.001). In case of verbal response also, there is a significant association between score and outcome (p=<0.01).

Table 5: MGCS scores individual components and outcome

MGCS components	No. of children (100)	Survived (68)	Death (32)	Chi-square	p-value
Ocular response					
1	33	6(18.2)	27 (81.8)	56.6	< 0.001 (HS)
2	53	48 (90.6)	5 (9.4)		
3	13	13 (100)	-		
4	01	01 (100)	-		
Motor response					
1	08	02 (25)	06 (75)	63.7	< 0.001
2	17	-	17 (100)		
3	31	22 (71)	09 (29)		

4	33	33 (100)	-		
5	11	33 (100)	-		
6	-	-	-		
Verbal response					
1	07	3 (42.9)	4 (57.1)	17.7	< 0.01
2	27	11 (40.7)	16 (59.3)		
3	54	43 (79.6)	11(20.4)		
4	11	10 (90.9)	01 (9.1)		
5	01	1 (100)	-		

MGCS scores were analysed by grading, and those with score of <8 were more prone to adverse outcome in terms of death with significant association (P<.001)(Table 6).

Table 6: Grouping of MGCS and outcome

Grade	No. of children	Survived	Death	Chi-square	p-value
Mild (13-15)	2	2 (100)	-	56.7	< 0.001 (HS)
Moderate (8-12)	58	56 (96.6)	2 (3.4)		
Severe (< 8)	40	10 (25)	30 (75)		
Total	100	68	32		

Table 7: Brainstem reflexes scores and outcome

Total score	No. of children	Survived	Death	Chi-square	p value
1	12	-	12 (100)	95.6	< 0.001 (HS)
2	21	1 (4.8)	20 (95.2)		
3	22	22 (100)	-		
4	45	45 (100)	-		

Brainstem reflex score was found to be a better predictor of outcome in terms of death in patients with acute non-traumatic coma. The score of more than 2 is predictive of better outcome (P = < 0.001) (Table 7). Brainstem reflex in its various components were analysed, and it was found that the absence of Brainstem reflexes in acute non-traumatic coma was associated with adverse outcome in terms of death (p < 0.001)(Table 8).

Table 8: Brainstem reflexes score and outcome

Components	No. of children	Survived	Death	Chi-square	p-value
Respiratory pattern					
Normal (1)	59	56 (94.9)	3 (5.1)	47.9	< 0.001 (HS)
Abnormal (0)	41	12 (29.3)	29 (7.7)		
Pupils					
Reactive (1)	72	58 (80.6)	14 (19.4)	18.6	< 0.001 (HS)
Non reactive (0)	28	10 (35.7)	18 (64.3)		
Corneal reflex					
Present (1)	94	68 (72.3)	26 (27.7)	13.6	< 0.001 (HS)
Absent (0)	06	0	06 (100)		
Doll's eye movement					
Present (1)	75	66 (88.0)	9 (12.0)	55.1	< 0.001 (HS)
Absent (0)	25	2 (8)	23 (92)		

In this study we have noted that there is a statistically significant correlation of MGCS to Brainstem stem reflexes in predicting the immediate outcome (p < 0.001) with spearman correlation coefficient of + 0.724 (p < 0.01). When both MGCS and brainstem reflexes were used together they have sensitivity and specificity of 78% and 97% respectively in predicting the immediate outcome in case of non-traumatic coma (Table 9).

Table 9: Brainstem reflexes in relation to MGCS

Brainstem reflexes	MGCS		Total
	< 8	[Symbol] 8	
1-2	31 (77.5)	2 (3.3)	33
3-4	9 (22.5)	58 (96)	67
Total	40	60	100

Chi square = 59.7 (p < 0.001), Spearman correlation coefficient + 0.724 (p < 0.01)

DISCUSSION

It is an established fact that the prognosis in coma depends on its severity. Assessing the severity of coma is subjective and poorly defined in terms such as stupor, semi-coma and deep coma. This was ineffective in predicting the outcome and there was a great deal of inconsistency when different observers carried out assessment (6). The Modified Glasgow coma scale is a standardized system developed initially in traumatic coma to assess the degree of coma and to identify the seriousness of brain injury in relation to outcome (7). It has gained wide spread use as it is highly reproducible, can be quickly performed at the bedside and provides useful information on the progress and prognosis of a comatose individual (8). Whereas using Brainstem reflexes avoids inter-observer variability and ambiguity in the score.

In the present study, more children were affected within the age group of 5-9 years (39%). Also in a study done at JIPMER, Pondicherry, more children were affected within the age group of 3-36 months (37%) (9). In another study at PGI Chandigarh, 34% cases were within the age group of 4-5 years (10).

In our study, low total MGCS score was found to be significantly associated with adverse short-term outcome in terms of death. The likelihood of death in patients with MGCS score less than 8 was much higher than when the MGCS was >8 (odds ratio 21.4, $p < 0.0001$). Similar findings were noted in a study conducted by Prabha PC et al at JIPMER, Pondicherry, who found that mortality was higher in patients with MGCS score < 8 (odds ratio 78.9% and relatively risk 27%) (9).

In our study Brainstem reflex score was found to be a better predictor of outcome in terms of death in patients with acute non-traumatic coma.

CONCLUSION

The present study concludes that children with Brainstem reflex score of less than 2 on admission have the worst prognosis and a very high probability of death. Those with Brainstem reflex score of more than 2 at the time of admission have good prognosis and better survival and outcome. Thus Brainstem reflex scoring is simple, easy, can be applied at bed side and does not need any investigations. Its application in developing countries and rural India helps treating pediatricians to decide on management and helpful in predicting the immediate outcome for counseling the parents regarding timing of referral where limited investigative and intensive care facilities prevail. The Glasgow Coma Scale is a standardized system and has gained widespread use as it is highly reproducible, can be quickly performed at the bedside and provides useful information on the progress and prognosis of a comatose individual.

The likelihood of death in patients with GCS less than 8 was much higher than when the GCS was >8 . Studies in both traumatic and non-traumatic coma have indicated that mortality is high when the GCS is less than 8. The MGCS recorded at admission had significant association with outcome. Mortality rates progressively increased with decreasing GCS score. Patient with GCS score of 8 or less may require aggressive management including ABC, mechanical ventilation and intracranial pressure monitoring. A good prognosis was observed in patients whose GCS was more than 8 on admission.

It was observed in our study that both MGCS and Brainstem reflex scoring done together is more accurate in predicting outcome and survival in non-traumatic pediatric coma. However, our study showed that brainstem reflex was easier and more feasible to do bedside.

REFERENCES

1. Tasker RL, Cole GF. Acute encephalopathy of childhood and intensive care. In: Pediatric Neurology. Brett EM ed. 3rd edn. Churchill Livingstone; Edinburgh: 1996, p.691-729.
2. Bhaty GB, Kapoor N. The Glasgow Coma Scale: A mathematical critic. Acta Neurochir 1993;120:132-135
3. Bazarian JJ. Prehospital and emergency department GCS scores. Brain Injury; 2003;17(7):553.
4. Healey C, Osler TM, Rogers FB. Injury, infection and critical care. J Trauma 2003;54:671-675.
5. Swaiman KF, Coma. In: Swaiman KF, Ashwal S, Ferriero DM ed. Pediatric Neurology – Principles and Practices. 3rd Edn. W.B. Saunders Company; Philadelphia 2002; p.864-865.
6. Bates D. Defining prognosis in medical coma. J Neurol Psychiatry. 1981;44:552-554.
7. Teasdale G, Jennett B. Assessment of coma and impaired consciousness: A practical scale. Lancet 1974;2:81-84.

8. Prasad K. The Glasgow Coma Scale – A critical appraisal of its clinimetric properties. J Clin Epidemiol 1996;49:755-763.
9. Nayana PC Prabha, Nalini P, Tiroumourougane VS. Indian J Pediatr 2003;40:620-625.
10. Bansal A, Singhi SC, Singhi PD, Khandelwal N, Ramesh S. Non Traumatic Coma. Indian J Pediatr 2005;72:467-473.