Original Research Article

Value of coma scale in prediction of mortality in non-traumatic coma in 1-12 years old children

Stalin Ramprakash[1], Bhavani M H[2*]

{[1]Assistant Professor, Department of Paediatrics} {[2]Associate Professor, Department of Obstetrics and Gynaecology}
Shridevi Institute of Medical Sciences and Research hospital, NH-4, Bypass Road, Tumkur- 572106, INDIA.
Email: hrbs2006@yahoo.co.in

Abstract

Background: Acute non-traumatic coma is a common problem in pediatric practice accounting for 10-15% of all hospital admissions and is associated with significant mortality. Assessment of the severity of coma is essential to comment on the likelihood of survival in comatose children. In the last three decades, various scores have been used to assess the severity of coma and to predict its outcome. Glasgow Coma Scale (MGCS) in spite of its various drawbacks has been widely used for assessing pediatric coma, though only few studies are available to support its use in pediatric coma as a whole. Hence the study was undertaken to evaluate the usefulness of coma scale in prediction of mortality in children between 1-12 years old admitted with coma of non-traumatic origin. **Methods:** A prospective study was conducted at Inpatient services of intensive medical care unit and general medical wards of Institute of child Health and Hospital for children, Egmore, Chennai, between October 2018 to November 2019. A Study Population consisting of children in the age group 1-12 years admitted in intensive care unit and medical wards with alteration in sensorium as one of the predominant complaints and admitted within 7 days of onset of coma were included. Sample size was 148. Chi-square test was used to study the association between the scores at Various times points and outcome. **Results:** It was observed that when the scores were between 3- 5 mortality rate was 67.0%, it was 17% when the minimal observed score was between 6-8. The group in which the minimal score never decreased be1ow 9 had no mortality. As the score increases the proportion of death decreases and the proportion having good recovery increases and vice versa. This type of association has been observed at different time points (Initial, 24 hrs, 48 hrs and 72 hrs). The significance of this association increases with the progression of time since admission. P value for the degree of association at various time points are: At presentation $P < 0.00001$, 24hrs - $P < 0.000001$, 48 hrs - $P < 0.000001$ and 72 hrs $P < 0.00000001$. **Conclusion:** There is highly statistically significant association between the GSC score levels and outcome. As the score increases the proportion of death decreases and the proportion having good recovery increases and vice versa.

Key Words: Glasgow coma scale, Mortality rate, Non traumatic coma.

[*]**Address for Correspondence:**
Dr Bhavani M H, Associate Professor, Department of Obstetrics and Gynaecology, Shridevi institute of medical sciences and research hospital, NH-4, Bypass road, Tumkur- 572106, INDIA.
Email: hrbs2006@yahoo.co.in
Received Date: 22/06/2021 Revised Date: 09/07/2021 Accepted Date: 14/08/2021
DOI: https://doi.org/10.26611/10141935

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 19 September 2021

INTRODUCTION

Acute non-traumatic coma is a common problem in pediatric practice accounting for 10-15% of all hospital admissions and is associated with significant mortality. Assessment of the severity of coma is essential to comment on the likelihood of survival in comatose children.[1] In the last three decades, various scores have been used to assess the severity of coma and to predict its outcome. These includes the Glasgow coma scale, the James adaptation of Glasgow coma scale, the Simpson and Reilly scale, the Children's coma scale, and the Jacob's scale. Among these, the modified Glasgow Coma Scale (MGCS) in spite of its various drawbacks has been widely used for

How to cite this article: Stalin Ramprakash, Bhavani M H. Value of coma scale in prediction of mortality in non-traumatic coma in 1-12 years old children. *MedPulse International Journal of Pediatrics.* September 2021; 19(3): 63-66. http://medpulse.in/Pediatrics/index.php

assessing pediatric coma, though only few studies are available to support its use in pediatric coma as a whole. Coma scales have been devised to determine the depth of unconsciousness in children and some have included brainstem signs.[2,3] Because of these limitations in assessing the prognosis, we need to device a system so that the prognosis can be easily assessed. It should be simple so that it can be practiced universally. It should be cheap, reproducible and reliable. Interpretation should be easier and should not require sophisticated training. Glasgow coma scale is one such system, the role of which in traumatic coma is well established. Initially it was used in evaluation of coma in adults due to head injury, later in children. It is not widely used in non-traumatic coma as a Prognostic indicator. As far as the use of Glasgow coma scale in children is concerned it cannot be directly applied to all age groups. So modification of the scoring system is necessary to suit the younger children especially those younger than. Hence the study was undertaken to evaluate the usefulness of coma scale in prediction of mortality in children between 1-12 years old admitted with coma of non-traumatic origin.

MATERIALS AND METHODS

A prospective study was conducted at Inpatient services of intensive medical care unit and general medical wards of Institute of child Health and Hospital for children, Egmore, Chennai, between October 1998 toNovember 1999. A Study Population consisting of children in the age group 1-12 years admitted in intensive care unit and medical wards with alteration in sensorium as one of the predominant complaints and admitted within 7 days of onset of coma were included. Coma recovering within 24 hrs, coma following trauma, poisoning, cardiac or respiratory illness as the main underlying problem were excluded. Sample size was 148. Severity of coma is assessed using Glasgow coma scale in children above 5 years and Adelidescore for children below 5 years. Serial scoring was done at 8 hr interval in the first 24 hrs and then at 24 hrs intervals till 5th day of admission. Statistical analysis: The sensitivity and Specificity of Various Scores regarding the prediction of mortality were arrived at and the optimal cut Off point was arrived by construction of Receiver Operative Characteristic Curve (ROC). Chi-square test was used to study the association between the scores at Various times points and outcome.

RESULTS

Table 1: Age and sex distribution, N=148

Age Group	Male n (%)	Female n (%)	Total n (%)
1-3 Years	34(23.0)	21(14.2)	55(37.2)
4-6 Years	28(18.9)	20(13.5)	48(32.4)
7-9 Years	10(6.8)	14(9.5)	24(16.2)
10-12 Years	8(5.4)	13(8.8)	21(14.2)
Total	**80(54.1)**	**68(45,9)**	**148(100)**

Table 2: Etiology and mortality.

Sl.No.	Etiology	Death (Proportional Morality Risk) n(%)
1	Viral encephalitis	8 (22.2)
2	Hepatic encephalopathy	13(61.9)
3	Pyogenic meningitis	6 (33.3)
4	Tuberculous meningitis	5(35.7)
5	Cerebral malaria	3 (30)
6	Renal encephalopathy	1 (10)
7	Vascular stroke	0
8	Diabetic ketoacidosis	0
9	Hypoxic ischemic encephalopathy	6 (85.7)
10	Seizure disorder with status epilepticus	1 (20)

In our study we have observed that the mortality is higher in hepatic encephalopathy (61.9%) and hypoxic ischemic encephalopathy (85.7%) most often following revival from cardiac arrest.

Table 3: Association between the score and mortality

Score	Death (%)	Total No. n(%)
3-5	53 (67.0)	79(53.4)
6-8	9 (17.0)	53 (35.8)
≥ 9	0	16 (10.8)
Total No.(%of Total	**62 (41.9)**	**148(100)**

Chi-Square = 57.31, P – < 0.000001

It was observed that when the scores were between 3- 5 mortality rate was 67.0%, it was 17% when the minimal observed score was between 6-8. The group in which the minimal score never decreased be1ow 9 had no mortality.

Table 4: Association between the score at presentation and mortality.

Score	Death (%)	Total No. n(%)
3-5	49 (69.0)	71 (48.0)
≥ 6	13 (16.9)	77(52.0)
Total No.(%of Total	**62 (41.9)**	**148(100)**

Chi-Square = 55.45, p = 0.00001

When the relationship between the scores at presentation and final outcome were analysed it was found that those with a score of 5 or less had a mortality of 69% whereas the mortality was only 16.9% in those who had the presentation score as 6 and above. There is significant association between the scores at presentation and final outcome ($p < 0.00001$)

Table 5: Association between the score after 24 hours and mortality.

Score	Death (%)	Total No. n(%)
3-5	45 (70.3)	64 (47.4)
≥ 6	4 (5.6)	71(52.6)
Total No.(%of Total	49 (36.3)	135(100)

Chi-Square = 60.63, p < 0.00001

Those who had scores less than or equal to 5 had a mortality rate of 70.3%. Whereas those with a score above or equal to 6 had only 5.6% mortality.

Table 6: Association between coma score after 48 hrs of admission and mortality

Score	Death (%)	Total No. n(%)
3-5	31 (72.0)	43 (35.0)
≥ 6	6 (7.5)	80(65.0)
Total No.(%of Total	**37 (30.1)**	**123(100)**

Chi-Square = 63.1, p < 0.00001

From our observations it can be made out that those with a score 5 or less at 48 hrs had 72%mortality whereas mortality for the group with score of 6 or more at 48 hrs was only 7.5%.

Table 7: Association between the coma scores at 72 hrs and mortality

Score	Death (%)	Total No. n(%)
3-5	16 (66.7)	24 (22.2)
≥ 6	6 (7.1)	84(77.80)
Total No. (%of Total	**22 (20.3)**	**108(100)**

Chi-Square = 72.1, p < 0.00000001

Those who had scores less than or equal to 5 at 72hrs had a mortality of 66.7% but those with 6 and above at 72 hrs had a mortality of about 7.1%. Analysis shows that there is highly significant association between the scores at 72 hrs and mortality ($p < 0.00000001$).

Table 8: Association between coma score trends and mortality

Change in score over 24 hrs	Death (%)	Total No. (% of Total)
No change deterioration	44 (55.7)	79 (58.5)
Improvement ≥1	5 (8.9)	56 (41.5)
Total n (% of total)	49 (36.3)	135(100)

Chi-square = 38.8, P <0.000001

When the coma score remained static or showed deterioration the mortality was 55.7% and it was 8.9% when the scores improved by atleast one. When there was no change or deterioration in coma score over 48 hrs the mortality was 57.1% and it was 7.4 % when there was improvement in the score by atleast one.

When coma score remained static or showed deterioration by 72 hrs the mortality was 59.3% and when there was improvement by atleast one during the same period the mortality was 7.4%. There was high degree of association between the change in scores over 72 hrs and the mortality.

Among those children in whom score deteriorated or did not improve over first five day period or till death, mortality was 80.0% and it was 7.7% for the group which showed an improvement in score by atleast one.

Table 9: Sensitivity and Specificity of the different scores at presentation as predictors of mortality

Scores that predict mortality		Death	Survival	Sensitivity (%)	Specificity (%)
3	3	16	1	25.8	98.8
	≥ 4	46	85		
4 or less	≥ 4	33	8	53.2	90.7
	≥ 5	29	78		
5 or less	≤ 5	49	22	79.0	74.4
	≥ 6	13	64		
6 or less	≤ 6	56	41	90.3	52.3
	≥ 7	6	45		
7 or less	≤ 7	58	52	93.54	39.5
	≥ 8	4	34		
8 or less	≤ 8	61	63	98.4	26.7
	≥ 9	1	23		
9 or less	≤ 9	62	74	100	14
	≥10	0	12		
10 or less	≤ 10	62	81	100	5.8
	≥11	0	5		

Coma score of 5 Predicts the mortality with optimum sensitivity (79.0%) and specificity (74.4%). By using receiver operating characteristic (ROC) curve the optimum score that has the maximum sensitivity and specificity can be arrived. Score 5 is the optimum cut off point for the prediction of mortality at presentation. Score 5 or less at presentation has increased mortality.

Table 10: Sensitivity and Specificity of different scores at 24 hrs as predictors of mortality

Scores that predict Mortality at 24hrs		Death	Survival	Sensitivity (%)	Specificity (%)
3	3	14	0	28.57%	100%
	≥ 4	35	86		
4 or less	≤ 4	30	18	61.22%	91.8%
	≥ 5	19	68		
5 or less	≤ 5	45	18	**91.8%**	**79.06%**
	≥ 6	4	68		
6 or less	≤ 6	46	32	93.9%	62.79%
	≥ 7	3	54		
7 or less	≤ 7	49	47	100%	45.3%
	≥8	0	39		
8 or less	≤ 8	49	61	100%	29%
	≥ 9	0	25		

The optimum score which predicts the mortality at 24 hrs with high sensivity 91.8% and specificity 79.06% is 5 or less. A score of 5 or less at 24 hrs is associated with poor outcome.

Table 11: Sensitivity and Specificity of different scores at 48 hrs as predictors of mortality

Scores that predict Mortality at 48 hrs		Death	Survival	Sensitivity (%)	Specificity (%)
3	3	11	0	29.7%	100%
	≥ 4	26	86		
4 or less	≤ 4	23	7	62.2%	91.9%
	≥ 5	14	79		
5 or less	≤ 5	31	12	**83.8%**	**86%**
	≥ 6	6	74		
6 or less	≤ 6	35	24	94.6%	72%
	≥ 7	2	62		
7 or less	≤ 7	37	37	100%	57%
	≥8	0	49		
8 or less	≤ 8	37	46	100%	46.5%
	≥ 9	0	40		

At 48 hrs score 5 or less predicts the mortality with high sensitivity 83.8% and specificity 86%. Score 5 or less at 48 hrs can be taken as optimum cutoff point below which the prognosis is poor.

Table 12: Sensitivity and Specificity of different scores at 72 hrs as predictors of mortality

Scores that predict Mortality at 72hrs		Death	Survival	Sensitivity (%)	Specificity (%)
3	3	4	0	18.2%	100%
	≥ 4	18	86		
4 or less	≤ 4	9	2	40.9%	97.7%
	≥ 5	13	84		
5 or less	≤ 5	16	8	72.8%	90.7%
	≥ 6	6	78		
6 or less	≤ 6	19	17	**86.3%**	80.2%
	≥ 7	3	69		
7 or less	≤ 7	20	24	90.09%	72.1%
	≥8	2	62		
8 or less	≤ 8	21	30	95.5%	65.1%
	≥ 9	1	56		

The optimum score with high sensitivity and specificity is score 6 (86.3% and 80.27% respectively). Score 6 or less of 72 predicts the mortality with high sensitivity and specificity.

DISCUSSION

Coma scale is a simple clinical tool which can be applied by any trained person. But inter observer variations are likely to occur. When uniform training is given to all those who would be applying the scale the variations can be minimized to a large event. The association between the coma score at various time points, change in scores with time and the mortality were studied using chi-square test. In our study we found that there is highly statistically significant association between the GSC score levels and outcome. As the score increases the proportion of death decreases and the proportion having good recovery increases and vice versa. This type of association has been observed at different time points (Initial, 24 hrs, 48 hrs and 72 hrs). The significance of this association increases with the progression of time since admission. P value for the degree of association at various time points are: At presentation $P < 0.00001$, 24hrs - $P < 0.000001$, 48 hrs - $P < 0.000001$ and 72 hrs $P < 0.00000001$. This high degree of association is in accordance with the study conducted by Soustiel *et al.*[4] who reported that among the clinical parameters GCS provided the most accurate prognosis (in 80%). Study done by Grewal *et al.*[5] who found that GCS trend or brain stem reflexes used alone were significantly correlated with outcome. Their study is with comatose children following head injury where as we have conducted the study in non- traumatic coma in children. We have studied the ability of different scores to predict the final outcome using their sensitivity and specificity at various time points viz. initial, 24hrs, 48hrs and72 hrs. We have arrived at the optimum scores that form a cutoff point in prediction of mortality and good recovery at various time points. Optimum scores that predict mortality, at presentation- Score 5 and below predicts increased mortality. Score 5 predicts mortality with sensitivity 79% and specificity 74.4%. At 24 hrs of admission - Score 5 and below predicts increased mortality. Score 5 predicts mortality with sensitivity 91.8% and specificity 79.06%. At 48 hrs of admission - Score 5 and below predicts increased mortality. Score 5 predicts mortality with sensitivity 83.8% and specificity 86.0%. At 72 hrs of admission - Score 6 and below predicts increased mortality. Score 6 predicts mortality with sensitivity 86.3% and specificity 80.2%. It can be seen that the optimum scores that predict mortality increase with time since admission. Longer a patient remains in a lower score poorer is the prognosis. The finding that the score of 5 or less within 24 hrs of hospitalization if associated with poor prognosis is in accordance with the study done by Awasthi *et al.* [6] from Lucknow. Rober H AHaslam[7] in Nelson textbook of pediatrics also reports that score 5 or less is associated with grave prognosis. In the study conducted by Reddy AM *et al.*[8] they concluded that a low total Glagow coma scale score was found to be associated with adverse short-term outcome. The likelihood of death in patients with GCS less than 8 was much higher than when the GCS was >8 i.e., 6 (15%) cases expired out of 38 cases with GCS ≤8 and 2 (4%) cases expired out of 42 cases with GCS >8. In a study by Cicero MX *et al.* [9]on pediatric trauma victims they concluded that the Glasgow coma scale is predictive of mortality and injury outcomes, as well as both Emergency Department and hospital length of stay, and has excellent prognostic accuracy. The Glasgow motor component has predictive value for injury and mortality that is nearly equivalent to the full Glagow coma scale.Though many studies have analysed the scores at presentation, cutoff points for different time intervals after admission were not analysed.

CONCLUSION

In our study we found that there is highly statistically significant association between the GSC score levels and

outcome. As the score increases the proportion of death decreasesand the proportion having good recovery increases and vice versa. This type of association has been observed at different time points (Initial, 24 hrs, 48 hrs and 72 hrs). The significance of this association increases with the progression of time since admission.

REFERENCES

1. Tasker RL, Cole GF. Acute encephalopathy of childhood and intensive care. In: Brett EM, eds. Pediatric Neurology. 3rd ed. Edinburgh, Churchill Livingstone; 1996. Simpson D, Reilly P. Paediatric coma scale. Lancet. 1982; 320(8295):450.
2. Born JD, Hans P, Albert A, Bonnal J. Interobserver agreement in assessment of motor response and brain stem reflexes. Neurosurg. 1987; 20(4):513-7.
3. Soustiel JF, Hafner H, Guilburd JN, Zaroor M, Leri L, Feinsod M. A physiological coma scale; Grading of coma by combined use of brain stem trigeminal and auditory evoked potentials and the Glasgow coma scale, electro encephalography and clinical Neurophysiology. 1993; 85(5): 277-283
4. Grewal M, Sutcliffe AJ. Early prediction of outcome following head injury: an assessment of Glasgow coma scale score trend and abnormal plantar and papillary reflexes. Journal of pediatric surgery. 1991; oct: 26(10): 1161-3
5. Awasthi S, Moin S, Tyer SM, Rehman H. Modified Glasgow coma scale to predict mortality in children with acute infections of central nervous system. National medical journal of India. 1997; sept-oct:10(5), 214-216.
6. Rober H A Haslam, Coma in children In :. Nelson Textbook of pediatrics 15th edition vol 2. Richard E Behrman, Robert M Kliegman.1996, p 1716-1718.
7. Reddy AM, Sreedhar G, Belavadi GB. Correlation of risk factors with Glasgow coma scale to predict the severity and outcome of children with non-traumatic coma. Int J ContempPediatr. 2019 Jul; 6(4):1524-1528.
8. Cicero MX, Cross PK. Predictive value of initial Glasgow coma scale score in pediatric trauma patients. PediatrEmerg Care. 2013 Jan; 29(1):43-8.

Source of Support: None Declared
Conflict of Interest: None Declared