Original Article

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Role of Modified Glasgow Coma Scale in Pediatric Non-traumatic Coma

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Abstract

Objective: To assess the utility of Modified Glasgow Coma Scale (MGCS) in pediatric non-traumatic coma and to predict the immediate outcome.

Design: Prospective observational study.

Setting: PICU of tertiary care teaching and referral hospital.

Study group: Consecutive children (n=100) between 5 months to 15 years with acute non-traumatic coma.

Methodology: MGCS and brainstem reflexes were assessed at 6 hourly intervals for 72 hours from the time of admission. The lowest score of the MGCS and worst brainstem reflexes were used for the analysis.

Outcome measure: Survival or death.

Results: The likelihood of death in patients with MGCS score <8 was much higher than when MGCS score was ³8, with odds ratio 21.4% and p<0.001. Among the individual components of MGCS, lower ocular response scores (p<0.001) and motor response scores (p<0.001) were better predictors than verbal response scores (p-0.01). Absence of one or more brainstem reflexes was associated with adverse outcomes and death (p<0.001). There was statistically significant correlation between MGCS and brainstem reflexes in predicting the immediate outcome with spearman correlation coefficient of +0.724 with p<0.01.

Conclusion: Ocular, motor response scores and brainstem reflexes were more predictive of the short term outcome than the total MGCS scores. A score incorporating ocular response, motor response and brainstem reflexes needs to be evaluated to assess the outcome in non-traumatic coma in the pediatric population.

Keywords: Coma; Glasgow Coma Scale; Outcome.

Introduction

Coma is a prolonged state of unarousable sleep and disturbance of consciousness usually resulting from lesions involving reticulum formation of brainstem, hypothalamus and connection with cerebral hemisphere.

Acute non-traumatic coma is a common problem in pediatric practice accounting for 10-15% of all hospitals admissions[1] and is associated with significant mortality. Assessment of severity of coma is essential to predict the outcome. Among the various scores used to assess the same, modified Glasgow coma scale has been widely used though only few studies are available to support its use in pediatric coma as a whole.

Neurological outcome in comatose children is a concern to parents and physicians. It may range from absence of impairment to severe disability and death. Etiology and clinical status at the time of presentation are likely predictors of outcome. Hence a better understanding of causes and outcome is essential to help improve the approach and plan rational management of non-traumatic coma. In this study, the etiology, clinical signs and severity of non-traumatic coma in children were

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examined to define the predictors of outcome.

Subjects and Methods

Consecutive 100 children between 5 months to 15 years of age with non-traumatic coma admitted to PICU of hospitals attached to J.J.M. Medical College, Davangere from January 2006 to January 2007, were included in the study.

Children with coma secondary to trauma, with neurodevelopmental delay and with any other pre-existing neurological illness were excluded from the study.

All patients underwent focused and serial neurological examination as per the standard protocol i.e., MGCS and Brainstem reflexes at 6 hourly intervals from the time of admission to 72 hours after admission and findings were recorded in the proforma.

The lowest score of MGCS and worst brainstem reflexes score (based on the number of reflexes present) were used for analysis.

Data from standardized study forms were entered into a computer database for analysis using SPSS software.

Age, sex, etiology, total MGCS score, score of the individual components and brainstem reflexes score, which were thought to be having an association with survival in acute coma were included in statistical analysis to predict the immediate outcome in a case of acute non-traumatic coma.

Results

Consecutive 100 children between age group of 5 m – 15 y were admitted with acute non-traumatic coma during the study period.

Characteristics of the study population were as follows:

Most of the children affected were between 1-9 years (77%). Modes of presentation were fever, headache, vomiting, convulsion, rashes, ingestion of toxins (kerosene, organophosphorus compounds), icterus, animal bite, edema, among which, most frequently encountered symptoms were fever and convulsions. Intracranial infection was the most common cause of coma in our study (68%) with dengue encephalitis (n=19) forming the largest group next being tubercular meningitis (n=18), pyogenic meningitis (n=12), other viral encephalitis (n=11), cerebral malaria (n=4), measles encephalitis (n=2), and enteric encephalopathy (n=2). As there was epidemic of dengue fever during our study period, large number of cases were attributed to it.

Variable	Number (%)
Sex	
Male	57
Female	43
Age distribution	
< 1 year	9
1 – 4	38
5 – 9	39
10 – 14	14

Metabolic disturbances contributed to 12% of comatose children and toxin induced, 10% of cases. Rest of the cases included hypertensive encephalopathy (n=7), atypical febrile convulsion (n=3). Mortality was highest in metabolic group (50%) and next being intracranial infections (32.36%).

Primary outcomes

In order to identify the factors that independently predicted the outcome, individual components of MGCS were analyzed with individual scores. It was found that lower ocular response scores ($p<0.001$) and motor response scores ($p<0.001$) were better predictors of death than the verbal response scores ($p<0.01$).

Total MGCS scores were grouped as mild (score 13-15), moderate (8-12) and severe (<8). Scores <8 were associated with adverse outcome ($p<0.001$).

Absence of brainstem reflexes (which included respiratory pattern, pupils, corneal reflex and doll's eye movement) was associated

MCGS 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 (HS)
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 (S)
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)	-		

with adverse outcome and death ($p<0.001$), and presence of atleast one or more of them at admission was associated with good outcome ($p<0.001$).

Outcome also depended on the availability of specific treatment for the individual conditions though the MGCS score was same for different conditions.

There was statistically significantly correlation of MGCS to brainstem reflexes in predicting the immediate outcome ($p<0.001$) with Spearman correlation coefficient of +0.724 ($p<0.01$).

Lower the MGCS score (<8) and absence of 1 or 2 brainstem reflexes has got better correlation with outcome in individual cases with spearman correlation coefficient +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. Also the diagnostic power of the test i.e., "predictive value" in predicting the immediate outcome (94% - positive predictive value and 87% - negative predictive value), with overall accuracy when both parameters i.e., MGCS and brainstem reflexes if used together was 87%.

Discussion

It is a well-known fact that prognosis in coma depends on its severity. Assessing the severity of coma by subjective, poorly defined terms such as stupor, semi coma, deep coma was ineffective in predicting the outcome and there was a great deal of inconsistency when different observers carried out assessment.[2] The Glasgow coma scale is a standardized system developed initially in traumatic coma and to identify the severity of brain injury in relation to outcome.[3] It has gained widespread use as is highly reproducible, bedside assessment and indicates the progress and prognosis of a comatose individual.[4]

Limitation of Glasgow coma scale is that only a few studies are available regarding its usefulness in non-traumatic pediatric coma as a whole.[5] Also there is loss of information due to summation of individual scores[6] i.e.,

the information conveyed by the total coma score is less than that contained in the individual three components.[7] Further the importance of individual components in assessing non-traumatic pediatric coma has not been well studied.

In our study, the likelihood of death in patients with MGCS score <8 was higher than when it was >8 (odds ratio 21.4, p<0.0001) and mortality was significantly higher when ocular response score was <1, verbal and motor scores were <2. Similar observations were made by Prabha PC *et al.*[8]

Brainstem reflexes are also important in the assessment and monitoring of comatose children.[9] In our study, we have also assessed the relationship between the presence or absence of brainstem reflexes and short term outcome in non-traumatic coma. We found that the absence of one or more brainstem reflexes was significantly associated with adverse outcome and death as similarly found by various authors in the past.[8,9,10] To conclude hence, brainstem reflexes should be used in tandem with MGCS and can be complementary in evaluation of such cases.

In our study, it has been noted that etiology did not significantly affect the shorter outcome.

In our study, CNS infection were the commonest cause of non-traumatic coma (68%) as previously observed.[11,12,13,14] However the type of infections seem to vary in different regions as in our study, it was Dengue fever (28%) and cerebral malaria was common in Africa.[15]

It is also important to realize that studies on prognosis of coma are affected by certain issues like self-limiting nature of the underlying disease, host response and treatment strategies and these are likely to have a significant effect on the outcome.[2] Further, death in coma often results not from the failure of primary neurological mechanisms but from other secondary non-neurological causes. Also, the distribution of etiology of coma in our study population was uneven with infection accounting for more than three-fourths of comatose patients. These issues could have affected the assessment of the effect of etiology on outcome in our study.

MGCS scoring is simple, easy, can be applied bedside. Its application in developing countries like India with limited investigative and intensive care facilities can help treating pediatrician to decide regarding management or referral and counseling the parents about the probable outcome. This is particularly helpful in resource limited countries like India for directing limited resources for maximal benefit and assessing its utility in predicting the immediate outcome in children with non-traumatic coma in hospital settings.

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