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Predictive Value of Glasgow Coma Scale (GCS) in Cerebrovascular Accidents

Farrukh Iqbal, Ambreen Gul, Shahadat Hussain
Department of Medicine, Shaikh Zayed Postgraduate Medical Institute, Lahore, 54600.

SUMMARY

There are various factors, which lead to coma and one of them is cerebrovascular accident (CVA). The severity of coma depends on the degree of brain damage. Various tools have been designed to measure the severity of coma including Glasgow Coma Scale (GCS), Acute Physiology and Chronic Health Evaluation (APACHE II), National Institute of Health (NIH) Stroke Scale, Modified Rankin Scale (MRS), Disability Rating Scale (DRS), Hunt-Hess Scale (HHS) and Mainz Emergency Evaluation System (MEES). A study was carried out on 200 patients with stroke in the Department of Medicine, Shaikh Zayed Hospital, Lahore and predictive value of GCS was studied as regards outcome in these patients with pattern of breathing, cerebral infarction, intracerebral bleed and mortality. One of the objectives was to compare the results with other studies, which are very few in the literature. The patients were divided in three groups, I, II and III. The mortality was significantly higher in group I ($p<0.0001$). Group I also had significantly higher rate of abnormal breathing ($p<0.0001$). According to GCS scoring, the conscious level was worse in intracerebral bleed as compared to cerebral infarction ($p<0.0001$), so was the high rate of mortality in intracerebral bleed as compared to cerebral infarction ($p<0.0001$). Therefore it was concluded that GCS (3-15) is related inversely to mortality. It was also concluded that GCS of 7 was associated with high mortality than GCS of 12. In spite of few flaws in the GCS, it is still used in emergency medicine to evaluate degree of coma and will be used in future as an easy, quick and effective tool to measure the level of consciousness.

INTRODUCTION

Stroke or "brain attack" occurs when blood supply to the brain is interrupted due to any reason, thus resulting in hypoxaemia. The brain cells are most vulnerable to the lack of oxygen and therefore result in variable degrees of neurological deficit depending upon the severity of the insult. The presentation of these patients varies from a Transient Ischaemic Attack (TIA) where the patient is fully conscious with no disability at all or in a deep comatosed state with laboured or Cheyne-Stokes breathing.

The measurement of outcome is fundamental to the effective evaluation of clinical management of life threatening illnesses. It is very important to know the level of consciousness and co-morbid factors in these patients as the outcome depends on its level. The chances of recovery are very remote if the patient is deeply comatosed. There have been different scales and scoring systems to assess the level of consciousness in these patients. These include Glasgow Coma Scale (GCS), Glasgow Outcome Scale (GOS and GOSE), Acute Physiology and Chronic Health Evaluation (APACHE II), National Institute of Health (NIH) Stroke Scale, Modified Rankin Scale (MRS), Disability Rating Scale (DRS), Hunt-Hess Scale and Mainz Emergency Evaluation System (MEES), but uptil now the standard, well tested and simple to use is the Glasgow Coma Scale (GCS).

PATIENTS AND METHODS

Two hundred consecutive patients with stroke in both sexes and age above 18 were included in this study. The level of consciousness was assessed

by Glasgow Coma Scale (GCS) and scores were recorded for each patient. Majority of patients either had cerebral infarction or intracerebral bleed leading to stroke.

Patients were divided in three groups, I, II and III according to the GCS scores of 3-6, 7-10 and 11-15 respectively.

Comparison with other scales i.e. APACHE II, or NIH stroke scale and MRS was not done. Standard GCS was applied and verbal, motor and visual responses were elicited and elaborated with some limitations. The standard GCS along with the score rating is shown as follows.

Glasgow Coma Scale

These scores are added together to compute the total scores. Minimum score is 3 and the maximum score is 15.

	Scores
Eye Open (E)	
Never	1
To pain	2
To verbal stimuli	3
Spontaneously	4
Best Verbal Response (V)	
No response	1
Incomprehensible sounds	2
Inappropriate words	3
Disoriented and converses	4
Oriented and converses	5
Best Motor Response (M)	
No response	1
Extension (decerebrate rigidity)	2
Flexion abnormal (decorticate rigidity)	3
Flexion withdrawal	4
Localizes pain	5
Obeys	6
Total Score	**3-15**

E+M+V=3 to 15

RESULTS

The level of consciousness and response was poor in Group I and almost normal in Group III. The higher the scores, the better is the level of consciousness and vice versa.

Overall outcome is shown in Table-1. It shows that majority of patients had GCS of 11-15 and were from group-III.

Table-2 shows relation of GCS with type of respiration. Majority of patients had normal breathing pattern in Group III of patients. Group I had significantly high rate of disturbed breathing including both Cheyne-Stokes and laboured breathing ($p<0.0001$).

Table 1: Glasgow Coma Scale (GCS) (n=200)

Group	*No.*	*%age*
I	46	23
II	50	25
III	104	52
Total	200	100

Table 2: GCS - Pattern of Respiration (n=200)

Group	*Type of Respiration*		
	Cheyne Stoke	*Laboured*	*Normal*
I	18 (09%)	19 (9.5%)	09 (4.5%)
II	06 (03%)	14 (7.0%)	30 (18.5%)
III	01 (0.5%)	04(2.0%)	89 (49.5%)
Total	25 (12.5%)	37(18.5%)	138 (69%)

Table-3 Shows relation of GCS to intracerebral haemorrhage and infarction. In intracranial haemorrhage, the conscious level was worse as compared to cerebral infarction ($p<0.0001$) and hence a low score on GCS.

Table-4 shows relation of intracerebral bleed and cerebral infarction and mortality. Mortality was significantly higher in intracerebral bleed as compared to cerebral infarction ($p<0.0001$). It was concluded that most of the patients who died were also from group-I.

Table-5 shows comparison of mortality in three groups of patients. It is shown that mortality is significantly high in group-I as compared to other groups ($P<0.0001$).

Therefore, it was obvious that application of GCS in these patients was of great importance and

can be used for assessing the predictive value of the outcome especially the mortality from stroke. It was concluded that low GCS scores were associated with higher mortality along with Cheyne-Stokes, laboured respiration and intracerebral bleed. In other words GCS scoring was inversely proportional to mortality. Other factors, for example, severe and life threatening infections and co-morbid conditions play an important role in the final outcome.

Table 3: GCS scoring and type of lesion.

Group	*Cerebral infarction*	*Intracerebral haemorrhage*	*%age*
I	15 (7.5%)	28 (14%)	43 (21.5%)
II	24 (12%)	14 (7%)	38 (19%)
III	94 (47%)	08 (4%)	102 (51%)

Table 4: GCS - ICH vs Cerebral Infarction

Group	*Intracerebral haemorrhage*	*Cerebral infarction*
Dead	14 (7%)	08 (4%)
Alive	36 (18%)	125 (62.5%)
Total	50 (25%)	133

Table 5: GCS - Comparison of overall mortality.

Group	*Dead*	*Live*
I	26 (13%)	20 (10%)
II	11(5.5%)	39 (19.5%)
III	07(3.5%)	97 (48.5%)
Total	44 (22%)	

DISCUSSION

Measurement of outcome is very important for effective evaluation of the clinical management of any illness both acute and chronic. In a diseased process e.g. cerebrovascular accidents and head injuries, which have an infinite variation in severity and are influenced by a number of variables, objective measures of outcome are critical in the assessment of treatment regimens.

There are numerous scoring systems and it is uncertain whether they are efficient in assessing the severity of illness and whether they have any predictive value to know the outcome especially in emergency situations. One of these scoring systems is Glasgow Coma Scale (GCS).

The GCS is usually applied in patients with traumatic brain / head injury and is used as recovery gauge after cardiopulmonary resuscitation to assess the brain damage. However in the literature, there are very few studies in which GCS and stroke outcome was compared and one of the objectives was to compare results of the present study with others.

Teasdale and Jenette first presented the Glasgow coma scale in 1974 as an aid for the clinical assessment of unconsciousness[1]. It was devised as a formal scheme to overcome the ambiguities and misunderstandings that arose when groups of comatosed patients were compared. The GCS has been used extensively to grade level of coma individually and to compare effectiveness of treatment and as a prognostic index[2].

It was shown that for prediction of mortality the best cut off points were 19 for APACHE II, 18 for MEES and 5 for GCS 2. GCS score provides the best indicator for the patients i.e. it is simple, less time consuming and an effective tool in an emergency situation. Poor outcome is associated with poor initial GCS score and vice versa and not with age[3,4]. It is a general observation that 90% of patients with a score of 7 or less are in coma. Patients with a score greater than or equal to 9 are usually not in coma. A score of 7 is critical. If the score is less than or equal to 7, even after six hours of coma, 50% of such patients die, whereas 9-11 score indicates a coma of moderate severity. A score greater than or equal to 12 indicates minor injury[5]. Coma is present if the patient is not opening the eyes, not obeying the commands and not uttering understandable words.

Patients with a score between 11-15 made good recovery than those with a score between 3-6. The patients with Cheyne-Stokes and laboured breathing

did worse as regard outcome, had to be transferred to ICU and developed more complications with increased mortality. A study also showed that patients with low scores on GCS who were on ventilatory support had a poor outcome[5].

The number of deaths was more in group I and II and the mortality was significant ($P<0.0001$). A study also showed that advancing age, low GCS and a large size of haematoma with interventricular extension of bleed was associated with a worse outcome[6,7]. It was also true for subarachnoid haemorrhage and it was concluded that a low GCS was associated with worst outcome[8].

Infarction in either the carotid or vertebro-basilar territory may lead to loss of consciousness. For example, an infarct involving one cerebral hemisphere may lead to such swelling that the function of the other hemisphere or the rostral brainstem is disturbed and coma results. Similarly, coma occurs with bilateral brainstem infarction when this involves the reticular formation, and it also occurs with brain stem compression after cerebellar infarction.

Outcome is comparatively better in ischaemic strokes if there are no signs of meningeal irritation or atrial fibrillation, but with a history of stroke and GCS equal to or more than 12. However, if the GCS is equal or less than 8, the outcome is worse[9,10].

It was observed in the present study that the GCS is inversely related to mortality. If GCS is less than or equal to 7 the mortality is much higher as compared to a GCS more than or equal to 12. A study was consistent with this finding and showed that a GCS of 7 or less, with hemianopsia and haemorrhagic stroke were significant predictors of 1-month mortality[11,12]. It is emphasized that other co morbid conditions also worsen the outcome. A study shows a higher and significant mortality with a GCS less than 10 ($P<0.001$)[13].

There are few drawbacks in the application of GCS and one of them is its inability to incorporate brainstem reflexes. One of the issues is application of GCS to intubated patients. The timings of initial assessment of scoring is also very important.

Application of GCS and presence of aphasia both receptive and expressive in patients with stroke can lead to a problem for the use of the full form of GCS (eye-verbal-motor, E-V-M). One study specifically compared the GCS with eye and motor subscale and had 87% accuracy as compared to 88% for the model with eye, motor and verbal scale. It was concluded from this study that short form GCS (eye-motor) is as good a predictor of early mortality (with in 2 weeks) as the full form GCS (eye-motor-verbal) in patients with stroke and disturbed brain reflexes[14]. This is quite helpful in aphasic patients as regards their scoring.

Glasgow Outcome Scale (GOS)[15] should not be confused with GCS which is used to assess the outcome after head injury. It may also be used to assess outcome of many other neurosurgical disorders. An extended form is called GOSE[16], which subdivides the last three categories of the GOS into two each to increase its sensitivity. It has its own limitations but one has to consider these scales as an instrument to measure the outcome in comatosed patients with substantial amount of brain damage in clinical and research work.

The data of present study confirms the findings of other studies in the literature. Although GCS has a few significant flaws, however due to its simplicity in application to these patients, it seems that GCS will be used in emergency medicine for sometime in future. A higher GCS has lower mortality and vice versa. It is therefore recommended that initial assessment should be done as soon as the patient comes in with stroke with disturbed level of consciousness and scoring should be recorded at regular intervals during admission to foresee the final outcome in the patients with stroke and markedly deranged level of consciousness.

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The Author:

Farrukh Iqbal
Associate Professor of Medicine
Shaikh Zayed Postgraduate Medical Institute
Lahore-54600.

Ambreen Gul
Senior Trainee Registrar
Department of Medicine,
Shaikh Zayed Postgraduate Medical Institute
Lahore-54600.

Shahadat Hussain
Senior Trainee Registrar
Department of Medicine,
Shaikh Zayed Postgraduate Medical Institute
Lahore-54600.

Address for Correspondence:

Farrukh Iqbal
Associate Professor of Medicine
Shaikh Zayed Postgraduate Medical Institute
Lahore-54600.