

Original Research Article

Correlation of Glasgow outcome score to Glasgow coma score assessed at admission

Harsha B. Kodliwadmth*, Sanjay N. Koppad, Mallikarjun Desai, Suresh P. Badiger

Department of General Surgery, SDM College of Medical Sciences, Sattur, Dharwad, Karnataka 580009, India

Received: 05 September 2016

Accepted: 10 September 2016

***Correspondence:**

Dr. Harsha B. Kodliwadmth,
E-mail: harshakodli@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Traumatic brain injury is one of the leading causes for morbidity and mortality in trauma cases. GCS is the standard scoring system used globally to assess the neurological status of patients with traumatic brain injury. The GOS is used to objectively assess and categorize patients recovering from head injury. In this study we assessed the GOS of patients recovering from traumatic brain injury and analysed its correlation with the initial GCS thereby evaluating the use of GCS in predicting recovery of patients with head injury.

Methods: 82 patients with isolated traumatic brain injury were included in the study. GCS was recorded at admission, 6 hours and 12 hours. GOS was recorded at 7 days and 28 days. Statistical analysis was done using Pearson's Correlation co-efficient.

Results: There was statistically significant positive correlation between GCS recorded on admission with GOS recorded on day 7 and GOS recorded on day 28. Positive Correlation was also seen between GCS recorded at 6 hours with GOS recorded on day 7 and GOS recorded on day 28. Similar positive correlation was also seen between GCS recorded at 12 hours with GOS recorded on day 7 and GOS recorded on day 28.

Conclusions: GCS can be used as a tool to stratify risk, prognosis and neurological recovery in patients with traumatic brain injury. It has to be used with caution in patients with polytrauma as other serious injuries may increase the risk, morbidity and mortality.

Keywords: Traumatic brain injury, Head injury, Glasgow coma score, Glasgow outcome score

INTRODUCTION

One of the leading causes of disability and death among patients sustaining trauma is traumatic brain injury. The level of disability can be minimised by timely assessment and administration of care, utilising grading systems and by following standard guidelines.¹ Early indicators or predictors of outcome after head injury can affect clinical decision making and the choice of case-specific approaches to rehabilitation.²

The Glasgow coma score (GCS) is the standard scoring system used globally in emergency departments as an objective indicator to assess the neurological status of patients with traumatic brain injury.³ It has been

frequently used as one of the most important predictors of outcome after traumatic brain injury. A score less than or equal to 8 is the traditional criterion for differentiating between severe and moderate to mild head injury, and patients' management is frequently dependent on this initial classification.⁴

The Glasgow outcome scale is used to objectively assess patients recovering from head injury and divide them into groups, which allows a standardized description of recovery. The assessment is divided into 5 categories which give a prediction of long term course of rehabilitation and recovery.⁵ Persisting disability after brain damage usually comprises both mental and physical handicap. The mental component is often the more

important in contributing to overall social disability. Lack of an objective scale leads to vague and over-optimistic estimates of outcome, which obscure the ultimate results of early management. A five-point scale is described death, persistent vegetative state, severe disability, moderate disability, and good recovery.⁵

The early prediction of outcome after traumatic brain injury (TBI) is important for several purposes, but no prognostic models have yet been developed with proven efficacy across different settings.⁶ Although the GCS has been previously demonstrated to predict mortality, efficacy in prediction of functional outcome has not been established.⁷

In this study we intend to assess the Glasgow outcome score of patients recovering from traumatic head injury and analyze whether it correlates with the initial Glasgow coma score. By doing this, we will be evaluating the use of Glasgow coma score in predicting recovery of patients with head injury.

Aims and Objectives of the study,

- a) To assess the utility of Glasgow outcome score of patients recovering from traumatic head injury.
- b) To correlate the Glasgow outcome score with the Glasgow coma score of the patient.
- c) To evaluate the use of Glasgow coma score in predicting the outcome of patients recovering from head injury.

Table 1: Glasgow coma scale.

	1	2	3	4	5	6
Eye	Do not open eyes	Open eyes in response to painful stimulus	Opens eyes in response to verbal command	Opens spontaneously		
Verbal	Makes no sound	In-comprehensible sounds	Utters inappropriate words	Confused	Normal oriented conversation	
Motor	Makes no movements	Extension to painful stimulus	Abnormal flexion to painful stimulus	Flexion/ withdrawal to painful stimulus	Localizes painful stimulus	Obeys commands

Table 2: Glasgow outcome scale.

Glasgow outcome scale		
Death	Severe injury or death without recovery of consciousness.	1
Persistent vegetative state	Severe damage with prolonged state of unresponsiveness and a lack of higher mental function.	2
Severe disability	Severe injury with permanent need for help with daily living.	3
Moderate disability	No need for assistance in everyday life. Employment is possible but may require special equipment.	4
Low disability	Light damage with minor neurological and physiological deficits	5

The data was compiled using the data compilation form. The initial Glasgow coma score was compared with the

METHODS

Patients with traumatic brain injury, admitted in SDM College of Medical Sciences and Hospital, Dharwad, Karnataka, India were included in the study. The study period was 6 months and a total of 82 cases were included in the study. Written informed consent was taken from the patients or patients’ relatives for inclusion in the study. Patients younger than 18 years of age were excluded from the study. Patients with other injuries like long bone fractures, blunt or penetrating injuries of chest or abdomen were also excluded from the study. Patients referred from other centers more than 24 hours following injury were also not included in the study.

The Glasgow coma score was assessed for every patient included in the study as mentioned in Table 1. This was done at the time of initial assessment on admission, at 6 hours and at 12 hours interval. The Glasgow outcome score was assessed by a questionnaire to the patients in the study. The scores are assessed and allocated at day 7, and day 28 following the head injury. The assessment questionnaire was administered in person if the patient was still admitted in the hospital or by a telephonic interview if the patient had been discharged. The Glasgow outcome score was assessed as per Table 2.

Glasgow outcome score of the patients and the values were correlated using standard statistical methodology

with Pearson’s correlation coefficient and evaluated for statistical significance.

RESULTS

This study was conducted in a tertiary care centre which caters to a mixed population i.e. from urban as well as rural area. As our hospital is located close to the National Highway, RTA cases form a major portion of the trauma case load in the hospital. Among our study subjects, 58 head injury cases were result of RTA while 19 were due to fall and 5 from other causes.

40.2% cases belonged to middle age i.e. 31 - 50 yrs while 18.3% were of geriatric age (>60 years). 87.8% cases were male.

GCS was assessed on admission, at 6 hours and 12 hours as shown in Table 3. On admission 65 patients had a GCS ≥13, 8 patients had GCS 9-12 while 9 had a score ≤8. Among those with minor head injury on admission (GCS ≥13), majority had a score of 15. Two patients with a score of 13 and 1 patient with a score of 14 improved after 6 hours of treatment to achieve a score of 15.

Table 3: Assessment of Glasgow coma score.

GCS	Admission	6 Hours	12 Hours
3	-	3 (3.7)	3 (3.7)
4	3 (3.7)	-	-
5	-	1 (1.2)	-
6	1 (1.2)	-	-
7	5 (6.1)	4 (4.9)	5 (6.1)
8	-	1 (1.2)	1 (1.2)
9	4 (4.9)	4 (4.9)	-
10	2 (2.4)	3 (3.7)	8 (9.8)
11	-	1 (1.2)	-
12	2 (2.4)	-	-
13	8 (9.8)	6 (7.3)	6 (7.3)
14	15 (18.3)	14 (17.1)	14 (17.1)
15	42 (51.2)	45 (54.9)	45 (54.9)
Total	82 (100)	82 (100)	82 (100)

Among 8 patients with moderate head injury on admission, 2 patients deteriorated from GCS 12 to GCS 10 after 6 hours. 4 patients with GCS 9 at 6 hours improved to GCS 10 after 12 hours. Thereby after 12 hours, the 8 patients continued to remain in the moderate head injury category (GCS 9-12).

Among 9 patients with severe head injury on admission (GCS ≤8), 3 patients deteriorated from a GCS 4 on admission to GCS 3 after 6 hours and continued in the same condition even after 12 hours. Only 1 patient improved from GCS 7 to GCS 8 at 6 hours. But, the total number of patients in severe head injury category continued to remain constant at 9.

Table 4: Assessment of Glasgow outcome score.

GOS	Day 7	Day 28
1	3 (3.7)	6 (7.3)
2	10 (12.2)	4 (4.9)
3	15 (18.3)	11 (13.4)
4	39 (47.6)	2 (2.4)
5	11 (13.4)	55 (67.1)
Total	78	78

GOS was measured on 7th and 28th day following head injury. The assessment questionnaire was administered in person if the patient was still admitted in the hospital or by a telephonic interview if the patient had been discharged. A total of 78 patients were assessed as shown in Table 4. Among the 4 patients who were not assessed, 3 had got discharged against medical advice while incorrect contact details were given by 1 patient.

On day 7, 3 patients had GOS 1 while it increased to 6 patients by day 28. 11 patients had GOS 5 on day 7 which increased to 55 patients by day 28. Majority patients saw improvement in GOS on day 28 as compared to day 7.

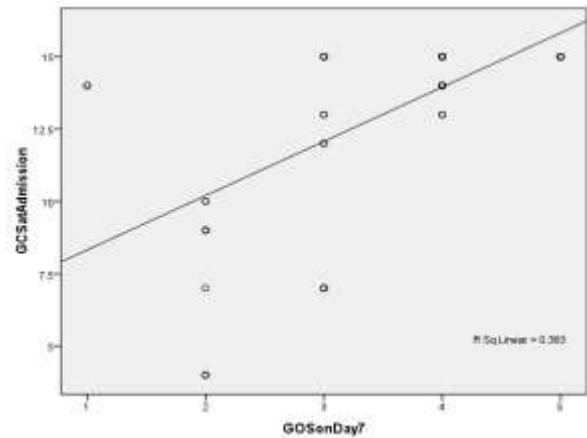


Figure 1: Correlation between GCS on day 1 and GOS on day 7.

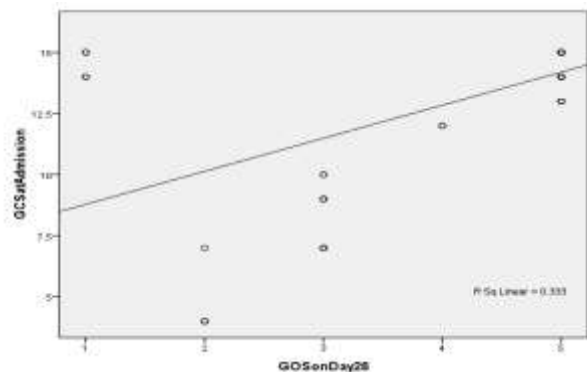


Figure 2: Correlation between GCS on Day 1 and GOS on Day 28.

There was statistically significant positive correlation between GCS recorded on admission with GOS recorded on day 7 ($r= 6.19$) and GOS recorded on day 28 ($r= 5.77$) as shown in Figure 1 and Figure 2 respectively.

Positive Correlation was also seen between GCS recorded at 6 hours with GOS recorded on day 7 ($r= 6.2$) and GOS recorded on day 28 ($r= 5.6$).

Similar positive Correlation was also seen between GCS recorded at 12 hours with GOS recorded on day 7 ($r= 6.06$) and GOS recorded on day 28 ($r= 5.55$).

DISCUSSION

The Glasgow coma scale (GCS) is routinely used in the acute care setting after traumatic brain injury to guide decisions in triage, based on its ability to predict morbidity and mortality. The best assessment of the neurological status at admission is by the Glasgow Come Scale. Although the GCS has been previously demonstrated to predict mortality, its efficacy in prediction of functional outcome has not been widely accepted. Determining the functional outcome of patients suffering from traumatic brain injury remains uncertain. The Glasgow outcome score can be used as an objective assessment for the patient's recovery following the traumatic brain injury.

In our study we assessed the GCS of patients with head injury at admission and at 6 and 12 hours. The GOS was assessed at 7 and 28 days following trauma. We attempted to correlate the GCS of the patients with the GOS, thereby evaluating the ability of the GCS as a prognostic indicator in predicting the functional outcome of these patients.

In our study we concluded that there was a statistically significant correlation between the GCS recorded at admission and at 6 hours and the GOS at day 7 and 28 following the trauma. Patients with a GCS of >10 at presentation had a good prognosis and recovered with no residual deficits. A GCS of <4 had a poor prognosis. Six deaths occurred during the course of the study. All these patients had GCS <7 at presentation which further reiterates the prognostic ability of GCS.

One of the main limitations of this study is the relatively small sample size and the fewer number of patients in the group of GCS 6 to 10. This may be significant, as higher number of these patients usually may require surgical intervention. Another important limitation of our study is that patients with injuries involving other systems have been excluded. Other injuries may be fatal or responsible for morbidity that the patients may experience. As the number of patients presenting with isolated traumatic brain injuries are fewer, this must be taken into account. Patients in the extremes of age groups are at an increased risk and must be considered accordingly.

In a study by Bastos et al, GCS was used to evaluate the outcome in patients with traumatic brain injury in ICU.^[12] The results were similar to our study where patients with GCS <4 at admission had a poor prognosis. In another study by Pal J et al, patients with GCS <9 were observed to have a poor prognosis. However it was a retrospective study and patients with polytrauma were included in the study. So deaths and poor outcome in the study could be attributed to other causes also.¹³

A study conducted by Udekwu P showed a good correlation existed between GCS score at admission (or pre-resuscitation) and functional outcome, as determined by rank correlation coefficients, whereas mortality falls steeply between a GCS score of 3 and a GCS score of 7 followed by a shallow fall which is similar to the findings in our study.¹⁴

Zafonte RD studied the relationship between Glasgow coma scale and functional outcome. The correlation analysis revealed only modest, but statistically significant, relationships between initial and lowest GCS scores and outcome variables. They concluded that GCS as a single variable may have limited value as a predictor of functional outcome. Hence in our study we have used GOS to assess the outcome and correlated it with GCS.¹⁵

GOS score has been found to be reliable and in some cases better predictor of disability as indicated by the study done by Pettigrew LE. The conclusion of the study states that Assignment of GOS scores based on information obtained using a structured interview format provides a more comprehensive assessment of disability than using the DRS (disability rating scale) or the ADL index (Barthel activities of daily living index).¹⁶

The simplicity and validity of GCS has gained it wide acceptance. Apart from the neurological assessment at admission the added benefit of a prognostic value certainly increases its value. Although it has its pitfalls with inter observer reliability no other scoring system has been able to replace GCS in the acute setting of traumatic brain injury. GOS has also proved itself over time as a reliable tool for assessing the recovery in patients of traumatic brain injuries.

CONCLUSION

In conclusion we can say GCS may be used as a tool to stratify risk, prognosis and neurological recovery in patients with traumatic brain injury. However as the study has not included patients with other injuries we would like to exercise a word of caution as patients with polytrauma may have prolonged morbidity and higher mortality than those with isolated traumatic brain injuries. Hence a complete assessment and evaluation of the patient must be done before stratifying the risk.

ACKNOWLEDGEMENTS

Authors would like to thank SDM College of Medical Sciences, Sattur, Dharwad, India.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Bullock MR, Chestnut RM, Clifton LG, Marion DW, Narayan RK, Pittis LH. Management and prognosis of severe traumatic brain injury. *J Neurotrauma*. 2000;17:451-553.
2. Matis GK, Birbilis TA. Poor relation between Glasgow coma scale and survival after head injury. *Med SciMonit*. 2009;15(2):CR62-65.
3. Middleton PM. Practical use of the Glasgow Coma Scale; a comprehensive narrative review of GCS methodology. *Australas Emerg Nurs J*. 2012;15:170-83.
4. Balestreri M, Czosnyka M, Chatfield DA, Steiner LA, Schmidt EA, Smielewski P, et al. Predictive value of Glasgow coma scale after brain trauma: change in trend over the past ten years. *J NeurolNeurosurg Psychiatry*. 2004;75:161-2.
5. Jennett B, Bond M. Assessment of outcome after severe brain damage. *Lancet*. 1975;1:480-4.
6. Hukkelhoven CW, Steyerberg EW, Habbema JD, Farace E, Marmarou A, Murray GD, et al. Predicting outcome after traumatic brain injury: development and validation of a prognostic score based on admission characteristics. *J Neurotrauma*. 2005;22(10):1025-39.
7. Zafonte RD, Hammond FM, Mann NR, Wood DL, Black KL, Millis SR. Relationship between Glasgow coma scale and functional outcome. *Am J Phys Med Rehabil*. 1996;75(5):364-9.
8. Bruns J, Hauser AW. The Epidemiology of Traumatic Brain Injury: A Review. *Epilepsia*. 2003;44(10):2-10.
9. Matis G, Birbilis T. The Glasgow Coma Scale - a brief review Past, present, future. *Acta Neurol Belg*. 2008;108(3):75-89.
10. Leitgeb J, Mauritz W, Brazinova A, Majdan M, Janciak I, Wilbacher I, et al. Glasgow Coma Scale score at intensive care unit discharge predicts the 1-year outcome of patients with severe traumatic brain injury. *Eur J Trauma Emerg Surg*. 2013;39(3):285-92.
11. Demetriades D, Kuncir E, Velmahos GC, Rhee P, Alo K, Chan LS. Outcome and Prognostic Factors in Head Injuries with an Admission Glasgow Coma Scale Score of 3. *Arch Surg*. 2004;139(10):1066-8.
12. Bastos PG, Sun X, Wagner DP, Wu AW, Knaus WA. Glasgow Coma Scale score in the evaluation of outcome in the intensive care unit: Findings from the Acute Physiology and Chronic Health Evaluation III study. *Crit Care Med*. 1993;21:1459-65.
13. Pal J, Brown R, Fleiszer D. The Value of the Glasgow Coma Scale and Injury Severity Score: Predicting Outcome in Multiple Trauma Patients with Head Injury. *J Trauma*. 1989;29(6):746-8.
14. Udekwu P, Kromhout-Schiro S, Vaslef S, Baker C, Oller D. Glasgow Coma Scale score, mortality, and functional outcome in head-injured patients. *J Trauma*. 2004;56(5):1084-9.
15. Zafonte RD, Hammond FM, Mann NR, Wood DL, Black KL, Millis SR. Relationship between Glasgow coma scale and functional outcome. *Am J Phys Med Rehabil*. 1996;75(5):364-9.
16. Pettigrew LE, Wilson JT, Teasdale GM. *J Neurosurg*. Assessing disability after head injury: improved use of the Glasgow Outcome Scale. 1998;89(6):939-43.

Cite this article as: Kodliwadmth HB, Koppad SN, Desai M, Badiger SP. Correlation of Glasgow outcome score to Glasgow coma score assessed at admission. *Int Surg J* 2016;3:1959-63.