

INTERNATIONAL TRAUMA LIFE SUPPORT

SMS (SIMPLIFIED MOTOR SCORE): A POTENTIAL FIELD MEASURE OF NEUROLOGICAL INJURY TO REPLACE TOTAL GLASGOW COMA SCORE

The guidelines and references contained in this document are current as of the date of publication and in no way replace physician medical oversight.

INTRODUCTION

Traumatic brain injury (TBI) affects millions of people each year.¹ The 15-point Glasgow Coma Scale (GCS) has become the most widely used clinical measure of TBI severity, both for physicians and emergency medical services (EMS) providers. In countries with Trauma Systems, assessment of TBI severity by EMS providers in the field may be used to determine the need for transport to a dedicated major trauma center. The appropriate choice of transport destination has been shown to improve outcomes in victims of trauma. Despite the common use of the GCS in trauma patients, concerns have been raised about validity, interrater reliability and ease of use. As a result, researchers have searched for simpler, more easily reproducible scoring systems. Examples of such systems include the AVPU (Alert, Voice, Pain, Unresponsive), the motor component of the GCS (mGCS), and the simplified motor score (SMS).

BACKGROUND

The National Expert Panel on Field Triage considered emerging evidence for the use of mGCS score during its literature search developing the 2011 guidelines because of lack of confirmatory evidence; the long-standing use of total GCS and its familiarity among current EMS practitioners; the inclusion of the motor score within the total GCS; and complications due to the difficulty of comparing scoring systems. Several studies have indicated a significant interrater variability in tallying the total GCS score, with discrepancies as high as 3 points.^{2,3,4}

Gill et al studied the interrater differences among emergency physicians in determining the GCS score and found that the agreement percentage for exact total GCS score was 32% whereas agreement percentage for the GCS-m component was 72%.⁵

Within the total GCS, even the assessment of the mGCS score suffers from lack of standardization, with variations based on type of painful stimuli applied to elicit responses and variations because of provider education.^{3,4}



Improving Trauma Care Worldwide

Several studies have consequently been conducted in the search for a simple assessment tool to allow rapid and accurate assessment of a trauma patient's condition for trauma triage in the prehospital setting.^{6,7,8,9,10}

A retrospective analysis of a statewide trauma registry of 393,877 adults aged 18 years and older from 1999 to 2013 indicated that the relative differences between the single mGCS <6 or "patient does not follow commands" and GCS score ≤ 13 were all below the pre-specified 5% threshold of clinical importance for 8 trauma outcomes tested, even when statistically significant.¹¹

The SMS is a three-point measure based upon the GCS motor response. The highest score of 2 is equivalent to the mGCS of 6 (patient obey commands). A score of 1 is equivalent to mGCS of 5 (patient localizes to pain). A score of 0 refers to mGCS of 4 or less.

CONSIDERATIONS

If the SMS is to replace the GCS for field neurological assessment, it should be compared with the GCS in a variety of EMS systems for predicting both mortality and other clinically important outcomes.

In a retrospective observational analysis of the Ohio State Trauma Registry from 2002 to 2007, a total of 92,704 records of patients aged 16 years and older who were transported by EMS were obtained from the registry to compare the discriminatory ability of the SMS with the GCS using receiver-operating characteristic curves. The objective was to compare the ability of the EMS-obtained SMS with the GCS as an accurate predictor of neurological outcomes and mortality in TBI.¹²

GCS was recorded both as a continuous variable and dichotomized at a cutoff of 13 or less. The cutoff of 13 or less was chosen as this is the current cutoff used by Ohio EMS providers in determining whether a patient meets the criteria for transport to a trauma center. The test characteristics used compared to SMS were: mortality, TBI, neurological intervention, emergency intubation, and ED intubation.

In a separate analysis, the study also calculated the non-parametric AUC for the GCS motor component alone compared to SMS. For each outcome, proportions and test characteristics (sensitivity, specificity, positive and negative likelihood ratios) with 95% CI were calculated. These were calculated for cutoffs of SMS of 0 and of SMS of 1 or less (any abnormal SMS) and they were also calculated for a GCS cutoff of 13 or less. The test characteristics at specified cutoffs were chosen as this is how they are used clinically by EMS providers. EMS providers



Improving Trauma Care Worldwide

dichotomize this variable to determine whether a patient has met the criteria for trauma center transport.

It was found that an SMS of 1 or less and a GCS of 13 or less had roughly equivalent sensitivity, specificity and LR for all outcomes. The greatest discrepancy came with sensitivity for neurosurgical intervention, in which the SMS was 7.1% less sensitive than the GCS. For many of these comparisons, although the proportions are clinically indistinguishable, the CI do not overlap. This again is probably an artifact of the study's large sample size with resulting tight CI. However, we agree with the authors and feel that proportions so close are clinically indistinguishable. Also, SMS has had similar test performance to the GCS for the prediction of mortality when obtained by prehospital providers.⁶ The SMS thus seems to be a useful marker of TBI and one that could potentially replace the GCS as a simple field measure of neurological injury.

MEDICAL OVERSIGHT

Medical oversight should review current literature and develop prehospital EMS protocols in regard to trauma triage and documentation. Implementation should be monitored and supervised through a quality assurance program.

CONCLUSION

ITLS believes that there is adequate evidence that the GCS motor component (mGCS) has near equal predictive power to the total GCS (tGCS). The SMS, which is based on the GCS motor component, performs as well as either of these (tGCS or mGCS) but is much easier to calculate.



Improving Trauma Care Worldwide

REFERENCES

1. Ghajar J. Traumatic Brain Injury. *Lancet*. 2000. 356:9233(923-9). [https://doi.org/10.1016/S0140-6736\(00\)02689-1](https://doi.org/10.1016/S0140-6736(00)02689-1).
2. Namiki J, et al. Inaccuracy and misjudged factors of Glasgow Coma Scale scores when assessed by inexperienced physicians. *Clin Neurol Neurosurg*. 2011;113:393-398.
3. Reith FC, et al. Lack of standardization in the use of the Glasgow Coma Scale. Results of international surveys. *J Neurotrauma*. 2016;33:89-94.
4. Bledsoe BE, et al. Glasgow Coma Scale scoring is often inaccurate. *Prehosp Disaster Med*. 2015;30:46-53.
5. Gill MR, et al. Interrater reliability of Glasgow Coma Scale scores in the emergency department. *Ann Emerg Med*. 2004;43:215-223.
6. Gill M, et al. A comparison of five simplified scales to the out-of-hospital Glasgow Coma Scale for the prediction of traumatic brain injury outcomes. *Acad Emerg Med*. 2006;13:968-973.
7. Haukoos JS, et al. Validation of the simplified motor score in the out of hospital setting for the prediction of traumatic brain injury and mortality. *Br J Surg*. 2012;99:122-130.
8. Thompson Do, et al. Validation of the simplified motor score in the out-of-hospital setting for the prediction of outcome after traumatic brain injury. *Ann Emerg Med*. 2011;58:417-425.
9. Brown JB, et al. Evidence-based improvement of the National Trauma Triage Protocol: the Glasgow Coma Scale versus Glasgow Coma Scale motor subscale. *J Trauma Acute Care Surg*. 2014;77:95-102.
10. Beskind DL, et al. A comparison of the prehospital motor component of the Glasgow Coma Scale (mGCS) to the prehospital total GCS (tGCS) as a prehospital risk adjustment measure for trauma patients. *Prehosp Emerg Care*. 2014;18:68-75.
11. Kupas DF, et al. Glasgow Coma Scale Motor Component (“ Patient Does Not Follow Commands”) Performs Similarly to Total Glasgow Coma Scale in Predicting Severe Injury in Trauma Patients. *Ann Emerg Med*. 2016;68:6:744-749.
12. Caterino JM et al. The prehospital simplified motor score is as accurate as the prehospital Glasgow Coma Scale: analysis of a statewide trauma registry. *Emerg Med J*. 2012;29:492-496.



Improving Trauma Care Worldwide

Current Thinking

SMS (Simplified Motor Score) – A Potential Field Measure of Neurological Injury to Replace Total Glasgow Coma Score International Trauma Life Support

The guidelines and references contained in this document are current as of the date of publication and in no way replace physician medical oversight.

Abstract

This is the current thinking of International Trauma Life Support (ITLS) with regard to the usefulness of a simplified motor score (SMS) as a simple reliable marker of traumatic brain injury in the prehospital setting.

Current Thinking

It is the position of International Trauma Life Support that:

1. There is sufficient evidence to support the use of mGCS and SMS in the assessment of the trauma patient's condition for trauma triage in the prehospital setting.
2. Replacement of the tGCS with a simple binary decision point of mGCS score less than 6 or a patient who "does not follow commands" predicts serious injury and would simplify out-of-hospital trauma triage.
3. The SMS, which is based on the GCS motor component, performs as well as either of these (tGCS or mGCS) but is much easier to calculate.



Improving Trauma Care Worldwide