Using a Motor GCS Score or “Patient Does Not Follow Commands” to Replace the Glasgow Coma Scale for Predicting Severe Injury in Trauma Patients

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Using a Motor GCS Score or “Patient Does Not Follow Commands” to Replace the Glasgow Coma Scale for Predicting Severe Injury in Trauma Patients

Abstract

Background: To assess an injured patient’s condition and to triage the patient to the appropriate facility, out-of-hospital providers use the Glasgow Coma Scale (GCS) even though the GCS has known inconsistent results. A GCS motor (GCS-m) less than 6 or “patient does not follow commands” would be an acceptable substitution to the full GCS to simplify trauma triage.

Method: An exhaustive literature search using MEDLINE-Ovid, Web Science, and CINAHL was conducted. The following search terms were used: “patient does not follow commands” and “Glasgow Coma Scale” which yielded 2 studies. Studies were assessed for quality using GRADE criteria.

Results: Studies confirmed that a simpler determination of “patient does not follow commands” can be as accurate as the total GCS score. One study showed that the difference between total GCS score less than or equal to 13 and GCS-m score less than 6 or “patient does not follow commands” were below their prespecified 5% threshold and thus clinically unimportant. The full GCS scale was found to be more sensitive and slightly less specific than the GCS-m score less than 6 for predicting an injury severity scale (ISS) greater than 15, with overall similar accuracy. Another study validated that GCS-m score less than 6 or “patient does not follow commands” had similar accuracy to the full GCS scale for multiple trauma outcomes, and the graphed sensitivity versus specificity was nearly identical for the GCS-m less than 6 and full GCS scores.

Conclusion: The simpler determination of GCS-m less than 6 or “patient does not follow commands” effectively predicts serious injury similarly to the more complicated total GCS score. The differences in specificity and sensitivity between GCS-m score less than 6 and total GCS score were similar, and accuracy were the same. It is recommended that the simpler “patient does not follow commands” replace the total GCS for out-of-hospital trauma triage.

Keywords: Glasgow Coma Scale and “patient does not follow commands”

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Capstone Project

Degree Name
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Glasgow Coma Scale, “patient does not follow commands”

Subject Categories
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Using a Motor GCS Score or “Patient Does Not Follow Commands” to Replace the Glasgow Coma Scale for Predicting Severe Injury in Trauma Patients

Jennifer Steinhaus

A Clinical Graduate Project Submitted to the Faculty of
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Abstract

Background: To assess an injured patient’s condition and to triage the patient to the appropriate facility, out-of-hospital providers use the Glasgow Coma Scale (GCS) even though the GCS has known inconsistent results. A GSC motor (GCS-m) less than 6 or “patient does not follow commands” would be an acceptable substitution to the full GCS to simplify trauma triage.

Method: An exhaustive literature search using MEDLINE-Ovid, Web Science, and CINAHL was conducted. The following search terms were used: “patient does not follow commands” and “Glasgow Coma Scale” which yielded 2 studies. Studies were assessed for quality using GRADE criteria.

Results: Studies confirmed that a simpler determination of “patient does not follow commands” can be as accurate as the total GCS score. One study showed that the difference between total GCS score less than or equal to 13 and GCS-m score less than 6 or “patient does not follow commands” were below their prespecified 5% threshold and thus clinically unimportant. The full GCS scale was found to be more sensitive and slightly less specific than the GCS-m score less than 6 for predicting an injury severity scale (ISS) greater than 15, with overall similar accuracy. Another study validated that GCS-m score less than 6 or “patient does not follow commands” had similar accuracy to the full GCS scale for multiple trauma outcomes, and the graphed sensitivity versus specificity was nearly identical for the GCS-m less than 6 and full GCS scores.

Conclusion: The simpler determination of GCS-m less than 6 or “patient does not follow commands” effectively predicts serious injury similarly to the more complicated total GCS score. The differences in specificity and sensitivity between GCS-m score less than 6 and total GCS score were similar, and accuracy were the same. It is recommended that the simpler “patient does not follow commands” replace the total GCS for out-of-hospital trauma triage.

Keywords: Glasgow Coma Scale and “patient does not follow commands”
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List of Abbreviations

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<th>Description</th>
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<tbody>
<tr>
<td>ATLS</td>
<td>Advance Trauma Life Support</td>
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<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>GCS-m</td>
<td>Glasgow Coma Scale motor</td>
</tr>
<tr>
<td>ISS</td>
<td>Injury Severity Score</td>
</tr>
<tr>
<td>GRADE</td>
<td>Grading of Recommendations, Assessment, Development, and Evaluations</td>
</tr>
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</table>
Using a Motor GCS Score or “Patient Does Not Follow Commands” to Replace the Glasgow Coma Scale for Predicting Severe Injury in Trauma Patients

BACKGROUND

Out-of-hospital providers assess an injured patient’s condition to properly triage the patient to the appropriate facility for care, including specific trauma centers. Accurate transportation can potentially reduce mortality and strain on resources. Trauma specific hospitals are prepared to implement advance trauma life support (ATLS), have available trauma-specific nurses and physicians, and have services available 24 hours.¹

The 2011 guidelines for trauma triage of injured patients were created for out-of-hospital personnel to help determine the most appropriate level of care for an injured patient. These guidelines outline a series of steps including an assessment of vital signs, the Glasgow Coma Scale (GCS), and the recommendation that patients with a GCS less than 13 be transported to a trauma center for appropriate trauma-specific care.²

The routine calculation of GCS is a 15-point scale comprised of 3 assessments of a patient’s functional ability which are eye response, verbal response, and motor response. Eye response is scored out of 4 points and determined by if the patient can open their eyes
spontaneously to verbal command, to pain, or has no response (see Table 1). Verbal response is scored out of 5 points and is determined by if the patient is properly oriented, confused, has inappropriate response, incoherent sounds, or has no response. Motor response is scored out of 6 points and is determined by if the patient can follow verbal commands, localizes to pain, withdraws from pain, decorticate to pain, decerebrate to pain, or has no response. After each component is assessed the scores are added together for a total score out of 15. Though the GCS is widely accepted as the optimal tool, it has been found to be unreliable given its subjectivity.\textsuperscript{3,4}

Studies have shown that there is significant variability in measuring the total GCS due to lack of standardization and inclusion of multiple subjective elements. Feldman et al\textsuperscript{3} found that out-of-hospital personnel could calculate the total GCS correctly 40% of the time. This shows that the GCS is complicated and can be difficult to apply in the field with out-of-hospital personnel. Gill et al\textsuperscript{4} studied the differences in GSC scoring among Emergency Medicine physicians and found that the agreement percentages for total GCS score was 32% compared to calculating only the motor component which was 72%. Therefore, suggesting the motor component is the most influential and consistent portion of GCS when assessing severe injury.
The National Expert Panel on Field Triage did not include using the simplified GCS-motor or “patient does not follow commands” in the 2011 guidelines due to “lack of confirmatory evidence, the long standing use of total GCS and its familiarity among current EMS practitioners, the inclusion of the motor scale within total GCS and complications because of the difficult of comparing scoring systems.”\(^2\)

If a simplified assessment of “patient does not follow commands” can be as predictive of a total GCS to determine severe injury, time can be potentially saved getting a patient to the proper facility for care. This assessment would also simplify out-of-hospital provider training and possibly improve trauma triage and care.

A calculated total GCS score of less than 13 may be more sensitive and less specific, causing more patients to be unnecessarily transferred to a trauma center which can cause a strain on hospitals’ resources.\(^6\) The importance of this research is to propose that a simpler measure of using the motor component of the GCS assessment, GCS-m score less than 6 or “patient does not follow commands,” to predict serious injury is equally effective to the full measure of the GCS scale.
METHODS

An exhaustive literature search using MEDLINE-PubMed, Web of Science, and CINAHL was conducted. The following search terms were used: “patient does not follow commands” and “Glasgow Coma Scale.” The bibliographies from several relevant background articles were used and inclusion/exclusion criteria were applied. Other inclusion criteria required human studies and studies published in the English language. Additionally, conferences or poster reports that did not report study details were excluded. A total of 2 articles were yielded by this search. Studies were assessed for quality using GRADE criteria (see Table 2).

RESULTS

The search of the 3 databases mentioned above resulted in an initial 46 articles. After removing duplicate articles and excluding those which did not meet the aforementioned eligibility criteria, a total of 2 articles remained for review. Both of these articles were retrospective observational studies (see Table 2).

Kupas et al retrospectively analyzed data from the Pennsylvania Trauma System Foundation’s Registry, which included trauma patients admitted to the state’s Level I, II, III, IV trauma centers from 1999 to 2013. The primary outcome measured was an injury severity score
(ISS) greater than 15, indicating major trauma which is also known as polytrauma. In this study, 28.7% of the patients included had an ISS greater than 15. 13.2% of the patients that were included had a GCS-m less than 6, and 15.2% had a GCS score <13. This study found that the difference between total GCS score less than or equal 13 and GCS-m score less than 6 or “patient does not follow commands” were below their prespecified 5% threshold for clinical importance ranging from 2.5% to 4.9% for sensitivity and -1.2% to -2.0% for specificity. All differences had a 95% confidence interval that did not cross zero.⁵

Hopkins et al⁶ performed a secondary analysis of data from the trauma registries from two Level I trauma centers: Loma Linda University Health and Denver Medical Center. Their principle objective was to validate the GCS-m score less than 6 or “patient does not follow” by predicting 5 outcomes relative to the total GCS score. These clinically important outcomes included emergency intubation, clinically significant brain injury, need for neurosurgical intervention, ISS greater than 15, and mortality. The demographics were significant for 22% of patients having a ISS greater than 15 and 12% of patients having a GCS-m less than 6. It was not specified what percentage of patient had a total GCS score less than 13. This study found that GCS-m score less than 6 was essentially identical to the total GCS score less than or equal to 13 for the prediction of all outcomes. The GCS-m
score less than 6 had positive likelihood ratios slightly superior (range of differences absolute 0 to 0.24, relative 0% to 11%) and negative likelihood ratios slightly inferior (range of difference absolute 0.01 to 0.06, relative 4% to 15%). Despite these findings, 6 of these 10 differences exceeded the 5% prespecified threshold for clinical significance, but when plotted on a prediction curve, the GCS-m less than 6 superimposed the GCS score less than or equal to 13. Though there is an increase in sensitivity of GCS-m less than 6 compared to total GCS less than 13, there is a corresponding loss in specificity.6

**DISCUSSION**

Though the full GCS is widely accepted given its inclusion in the National Field Trauma assessment guidelines from the CDC, the data from these studies5,6 supports that using the simplified motor GCS scale or “patient does not follow commands” could replace the standard full GCS to measure a patient’s trauma severity.

Both studies5,6 confirmed that a simpler determination of “patient does not follow commands” can be as accurate as the assessment of total GCS score. The simplified assessment is practical when considering the potential time that could be saved making field triage decisions or time saved training out-of-hospital personnel.
Kupas et al\textsuperscript{5} found that the difference between total GCS less than or equal to 13 and GCS-m less than 6 were below their prespecified 5% threshold for clinical importance. Thus, confirming the determination of “patient does not follow commands” is as predictive of severe trauma as the full GCS. Hopkins et al\textsuperscript{5} validated the results of Kupas et al\textsuperscript{5} that the simplified “patient does not follow commands” predicted trauma outcomes as effectively as the existing full GCS score.

Hopkins et al\textsuperscript{6} was missing at least 1 component of the GCS assessment calculated by out-of-hospital personnel for approximately one third of the patients included in the study. It was suggested that the GCS scores may have inconsistently documented because of the perception of limited contribution or burden of its calculation.\textsuperscript{6} These barriers to the utilization of the total GCS may be overcome by implementing a simplified GCS-m score of less than 6 or “patient does not follow commands.”

Some may argue that the GCS has value beyond the score less than or equal to 13 that currently used for field trauma triage. For example, a common practice of providers is that a GCS score less than 8 indicates that the patient may require intubation. Unfortunately, there is no evidence that supports this belief that specific values can guide clinical judgement.\textsuperscript{7,8} Wears\textsuperscript{9} observed that “the persistence of
the GCS is due not to its clinical utility but rather its psychological comfort.” A simpler scale could potentially provide enough information for the provider that the trauma patient may require more advanced care.

These studies have some limitations. Kupas et al\textsuperscript{5} analyzed data only from Pennsylvania, and a large portion of the data was specifically patients with blunt trauma. It is unknown if this study could be applied to other areas of the country that operate under different systems or have predominantly different mechanisms of injuries. Another limitation of this study is that approximately half of the first reported GCS scores were determined by hospital providers rather than out-of-hospital personnel. The score of GCS performed by a hospital provider may yield different results compared to GCS completed by an out-of-hospital provider because they receive different education and training. The study did do a subgroup analysis of in-hospital and out-of-hospital personnel which they reported had similar results. Lastly, as briefly discussed above, a limitation of Hopkins et al\textsuperscript{6} is that at least 1 out-of-hospital GCS subscale assessment was missing in approximately one third of entries at the hospitals included in the study. They performed multiple imputations to compensate for such missing data.
**CONCLUSION**

During trauma triage, the simpler determination of “patient does not follow commands” effectively predicts serious injury similarly to the more complicated total GCS score. For all outcomes, the differences in specificity and sensitivity between GCS-m score less than 6 and total GCS score were clinically unimportant. Therefore, it is recommended the simpler “patient does not follow commands” replace the total GCS for trauma triage. To strengthen this recommendation, further studies and clinical trials should be performed to truly determine the efficacy of the motor GCS score less than 6 or “patient does not follow commands” compared to the full GCS.
References


Table 1: Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Glasgow Coma Scale</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Opening</strong></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td>To speech</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>Verbal Response</strong></td>
<td></td>
</tr>
<tr>
<td>Oriented</td>
<td>5</td>
</tr>
<tr>
<td>Confused conversation</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>Motor Response</strong></td>
<td></td>
</tr>
<tr>
<td>Obey's commands</td>
<td>6</td>
</tr>
<tr>
<td>Localizes pain</td>
<td>5</td>
</tr>
<tr>
<td>Normal flexion (withdrawal)</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal flexion (decorticate)</td>
<td>3</td>
</tr>
<tr>
<td>Extension (decerebrate)</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table 2: Quality Assessment of Reviewed Articles

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of studies</th>
<th>Study Designs</th>
<th>Downgrade Criteria</th>
<th>Upgrade Criteria</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS &gt;15</td>
<td>2</td>
<td>Cohorts</td>
<td>Serious&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>ISS &gt;24</td>
<td>1</td>
<td>Cohort</td>
<td>Not Serious</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Died (Mortality)</td>
<td>2</td>
<td>Cohorts</td>
<td>Serious&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>ICU Admission</td>
<td>1</td>
<td>Cohort</td>
<td>Serious&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Intubation</td>
<td>2</td>
<td>Cohorts</td>
<td>Serious&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Trauma Care</td>
<td>1</td>
<td>Cohort</td>
<td>Not Serious</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Surgery</td>
<td>1</td>
<td>Cohort</td>
<td>Serious&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Craniotomy</td>
<td>1</td>
<td>Cohort</td>
<td>Serious&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>CSBI</td>
<td>1</td>
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<td>Not Serious</td>
<td>Not Serious</td>
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<tr>
<td>NSI</td>
<td>1</td>
<td>Cohort</td>
<td>Not Serious</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
</tbody>
</table>

<sup>a</sup> Failure of accurate measurement of all known prognostic factors due to missing data in Hopkins et al study<sup>1</sup>.

<sup>b</sup> Failure of accurate measurement of all known prognostic factors due to missing data in Kupas et al study<sup>2</sup>.