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[Articles]

Efficacy of the Motor Component of the Glasgow Coma Scale in Trauma Triage

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Abstract

Background: National guidelines recommend that patients with Glasgow Coma Scale (GCS) scores of less than 14 be triaged to trauma centers. We hypothesized that the motor component of the GCS (GCSM) would be equally sensitive as the total GCS in head injury triage.

Methods: A 2-year retrospective review of 3,235 injured adults transported directly to a Level I trauma center.

Results: One thousand four hundred ten patients (44%) had prehospital GCS scores recorded. GCSM was found to have a sensitivity of 0.90 for Abbreviated Injury Scale (AIS) score = 5 head injury and 0.61 for AIS score > 3 injury, whereas the GCS had sensitivities of 0.92 and 0.62, respectively (p = not significant). Specificities were equal at 0.85 for AIS score = 5 and 0.89 for AIS score > 3.

Conclusion: GCSM is equivalent to GCS for prehospital triage, and in view of its simplicity it should replace the GCS in triage schemes.

Field triage of civilian trauma patients has evolved with the implementation and growth of modern trauma systems. An optimal triage system separates those patients who require the resources of the trauma center from those who do not, with both sensitivity and specificity of 1.0. In addition, this system must be rapidly applicable by field personnel with limited training under adverse environmental conditions.

Triage tool development has taken several different paths. Scoring systems have been empirically derived (e.g., Trauma Index, Triage Index, and Circulation Respiration, Abdomen, Motor, and Speech [CRAMS] Scale)

or transplanted from the hospital environment (Trauma Score, Glasgow Coma Scale). [1-5] These systems have been evaluated subsequently in the field. Triage guidelines such as those of the American College of Surgeons Committee on Trauma (ACSCOT), which incorporate physiologic parameters, scoring systems, anatomic considerations, and mechanism, have also been developed empirically and then tested in the field. [6]

All of these triage scores and systems incorporate some form of neurologic evaluation. The Glasgow Coma Scale (GCS) is incorporated in the Triage Index, [2] Trauma Score, [4] Revised Trauma Score, [7] Triage Rule, [8] and ACSCOT guidelines. [6] Baxt et al. [8] and Meredith et al. [9] both suggested that the motor component of the Glasgow Coma Scale (GCSM) is a good indicator of the presence of severe injury. Meredith et al. found the GCSM equal to the Trauma Score for mortality prediction and proposed that the GCSM be the sole triage scale used in the prehospital environment. [9]

We hypothesized that prehospital GCSM scores would be as effective as total GCS scores in identifying individuals with severe brain injury. We therefore undertook a retrospective review of patients transported to our Level I trauma center.

MATERIALS AND METHODS

Data regarding the prehospital condition and care of all trauma patients transported to the Level I trauma center at our institution were concurrently collected in our institutional computerized trauma registry. Prehospital data were obtained from run sheets completed by the emergency medical services personnel at the time of patient care or shortly thereafter. Prehospital GCS score, Trauma Score, and triage indications were recorded in the registry. In addition, demographic data, diagnoses, details of care, Abbreviated Injury Scale (AIS) scores, [10] Injury Severity Scores, [11] and patient outcome were recorded. The Glasgow Coma Scale score obtained before prehospital treatment was recorded in the registry.

Our region has a dual-response emergency medical system. The majority of basic life support care is provided by unregulated volunteer services. Advanced life support is provided by regulated professional paramedics. In 1994, the New Jersey Department of Health began a trauma triage training program for prehospital providers, organized through the state-designated trauma centers. [12] This course included training in GCS scoring. For this reason, we chose to review the 2-year period beginning July 1, 1994.

All adult patients (aged 13 years or older) transported directly to the trauma center were included. Patients seen initially at another hospital and transferred to our care were excluded.

Based on ACSCOT guidelines, we defined GCS score < 14 as a positive triage by GCS and GCSM score < 6 as positive triage by the motor component of GCS. Using the AIS-90 dictionary, we defined severe head injury (AIS score = 4 or greater) as a patient requiring trauma center care for brain injury. Sensitivity and specificity were calculated, and statistical analysis by chi squared test was applied as appropriate.

RESULTS

During the 2-year study period, 3,235 adult trauma patients were transported directly to the trauma center. Prehospital personnel recorded GCS scores for only 1,410 of these patients (44%). Airway intubation was performed in the field in 115 patients (3.5%); 65 of these (4.6%) had GCS scores recorded by field personnel. Helicopter transport was used for 642 of these patients, 442 were transported by ground basic life support alone, and 326 were transported by combined ground basic and advanced life support. Motor vehicle crashes accounted for 898 victims, gunshot wounds for 140, falls for 162, assaults for 89, and miscellaneous causes for 121. Eighty-five percent of the injuries were caused by blunt mechanisms.

There were 979 males and 431 females in the group, and their mean age was 37.1 years (range, 13-95 years). Mean and median Injury Severity Scores were 14.4 and 13, respectively, and there were 94 deaths in the group. Two hundred nine patients suffered major head injury, with 148 (10.5%) suffering AIS score = 4 injury and 61 (4.3%) suffering AIS score = 5 injury. AIS score = 3 head injury occurred in 230 patients (16.3%), concussion (AIS score = 1 or AIS score = 2) in 353 patients (25%), and 618 patients (43.8%) had no head injury. Nineteen patients underwent emergent craniotomy for extra-axial hematomas.

GCS score was less than 14 in 265 patients (19%). GCSM score was less than 6 in 252 patients (18%). One hundred twenty-nine of 209 patients with severe brain injury were identified by GCS triage, whereas 127 would have been distinguished by GCSM triage (p = not significant) (Table 1). To reduce the confounding effect of shock on neurologic status, we eliminated the patients (n = 3) who arrived at the trauma center with systolic blood pressure less than 90 mm Hg. GCS score < 14 once again identified 129 of 206 patients with severe head injury in this group, whereas GCSM score < 6 identified 127 of 206 (p = not significant). Sensitivity and specificity of GCS and GCSM for both AIS score = 5 and combined AIS score = 4 and 5 injuries are shown in Table 2.

Group	Patients	AIS Score = 4	AIS Score = 5
GCS score < 14	265	73	56
GCS score > 13	1,145	75	5
GCSM score < 6	252	72	55
GCSM score = 6	1,158	76	6

Table 1. Identification of major head injury by GCS or GCSM score

Indicator	AIS Score = 5 Sens./Spec.	AIS Score = 4 and 5 Sens./Spec.
GCS	0.92/0.85	0.62/0.89
GCSM	0.91/0.85	0.61/0.89

Sens./Spec., sensitivity/specificity.

Table 2. Sensitivity and specificity of GCS and GCSM

Thirteen of 19 patients who required craniotomy (68%) were identified by GCSM scores < 6, and 12 (63%) were identified by GCS scores < 14 (p = not significant). Six patients who required emergent craniotomy had both GCS score > 13 and GCSM score = 6.

Many states' triage systems (including New Jersey's) use GCS scores < 13 as a standard for trauma center triage. To evaluate the difference between GCSM and GCS in that environment, we evaluated the 27 patients with prehospital GCS scores of 13. Five patients in this group (19%) suffered AIS score = 4 injury, four of whom had GCSM scores less than 6.

Ninety-four patients died in the study population. The mortality for patients with GCS scores < 14 was 67 of 265 (25%) and for patients with GCSM scores < 6 was 68 of 252 (27%) (p = not significant), versus 2% for those with GCS scores > 13 or GCSM scores = 6.

DISCUSSION

Triage remains a challenge for prehospital care providers. Baxt et al. [13] demonstrated that although a variety of triage rules could predict mortality well, none could distinguish patients with major nonlethal injury with a sensitivity of greater than 65% while maintaining a false-positive triage of less than 35%. Kane et al. [14] found the Trauma Score only 17% sensitive for major injury, whereas the CRAMS score was 72% sensitive. Morris et al. [5] demonstrated a Trauma Score less than 14 to be 63% sensitive and 88% specific for potentially life-threatening injuries and 80% sensitive for "closed head injury." Emmerman et al. [16] prospectively evaluated four triage rules and found that all four could predict death with 100% sensitivity and that the prediction of need for operation was 85% or better for all four. They also concluded that emergency medical technician judgment performed as well as any of the tested scales. [16]

Although the ability of prehospital providers to perform scoring accurately has been demonstrated, [17] the complexity of the scoring systems may interfere with their use in actual practice. Only 15 to 30% of North Carolina trauma patients had field Trauma Scores recorded. [9] In our experience, Trauma Scores were recorded by prehospital providers in 39% of cases and GCS scores were recorded in 44% of cases. There is no mandatory record keeping for volunteer ambulance personnel in New Jersey, and triage guidelines are advisory, not mandatory, even for professional advanced life support providers. This may have contributed to the low reporting rate for prehospital GCS scores. Interestingly, before the introduction of the statewide triage course, GCS scores were recorded by emergency medical technicians or paramedics on 63% of patients presenting to our center.

The GCS score was initially developed as a prognostic tool for brain injury. [5] Although the GCS score has been useful in the identification of patients likely to have brain injury, [18,19] particularly at the level of GCS score = 13, and in outcome for brain injury, [20] reported experience with the value of prehospital GCS score in triage for brain injury is limited. Winkler et al. [21] demonstrated that prehospital GCS score had no prognostic value for outcome of patients with brain injury.

Baxt et al., [8] using paramedic-based prehospital data, demonstrated that GCSM score less than 5 was a strong identifier for patients with major trauma. Meredith and associates, [9] primarily using emergency

department admission data, showed that the inability to follow commands (GCSM score < 6) was a good indicator of risk for death but not for severity of injury. They felt that the GCSM score alone was as effective as the Trauma Score in identifying patients with severe and lethal injuries. In view of their demonstrated low compliance with trauma scoring by field personnel, they suggested that the more complex Trauma Score and Glasgow Coma Scale score be replaced by the GCSM score for prehospital triage use.

Similarly, our data indicate that the GCSM is equivalent to GCS for identification of patients at risk for death. We have also demonstrated that the motor component of the GCS is virtually equivalent to the total GCS in the identification of severe brain injury and is superior in the group with GCS scores of 13. Although our study is limited by the small population size and the selection bias of triage to a trauma center, we feel that our results are compelling.

In view of the simplicity of the GCSM, its substitution for the GCS in triage systems, such as the ACSCOT guidelines, might lead to a higher use rate among prehospital providers. Because its sensitivity and specificity for brain injury are equal to that of the GCS, increased use, over the demonstrated low use of GCS, could lead to improved triage for severe brain injury. In areas such as New Jersey, where triage is conducted using Glasgow Coma Scale scores of less than 13 to select patients for transport to a trauma center, use of the motor component alone could result in more sensitive triage of patients with brain injuries.

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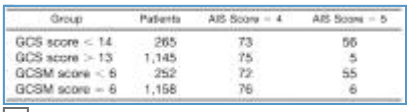

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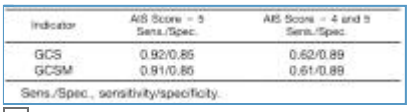
Table 1



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Sens./Spec., sensitivity/specificity.

Table 2

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