

Head-Abbreviated Injury Scale is an Unreliable Measure for the Presence of Brain Injury



Marianne J. Vandromme MD, Paul MacLennan PhD, Russell Griffin MPH, Michael Minor EMT-P, Loring W. Rue, III MD, Jeffrey D. Kerby MD PhD

UAB Center for Injury Sciences, Department of Surgery, UAB Injury Control Research Center- Birmingham, AL

Background

Traumatic brain injury (TBI) can be determined via several methods, both physiologic and anatomic. The most widely use method, Glasgow Coma Scale (GCS), employs purely physiologic measures and when used alone is a poor predictor of TBI, survival, and functional outcome¹.

Non- physiologic techniques of determining TBI include the Abbreviated Injury Scale (AIS), an anatomic scale, and the Marshall Classification score (MS), a radiographic scale based on head computed tomography scans.

Typically, a head component AIS (H-AIS) ≥ 3 on an ordinal scale ranging from no injury/normal (0) to unsurvivable (6) is considered TBI and is frequently used as a proxy determinant for the presence of TBI in clinical research. Given the extra-cranial components included within the H-AIS can impact the overall score; use of H-AIS may not be a valid surrogate for the classification of TBI. Alternatively, the MS only evaluates intracranial effects of injury in determining TBI and highly correlates with survival and functional outcomes².

These two non-physiologic methods of identifying TBI have never been directly compared in the presence of physiologically determined TBI (via GCS).

This study seeks to describe the performance of the H-AIS in identifying TBI in patients with Prehospital (PH) GCS ≤ 8 .

Methods

Patients presenting to a level I trauma center between January 2006 and April 2008 with blunt mechanism of injury and PH GCS ≤ 8 were included.

Initial head computed tomography scans were reviewed and assigned a MS (see table 1). Patients were categorized based on presence or absence of TBI via both MS > 1 and H-AIS ≥ 3 .

Sensitivity and specificity analysis was performed to evaluate the effectiveness of H-AIS in determining TBI as defined by MS.

Score	Injury Characteristics
1	No visible intracranial pathology
2	Cisterns present, with midline shift 0 to 5 mm; no high-density lesion >25 mL
3	Cisterns compressed or absent, with midline shift 0 to 5 mm; no high-density lesion >25 mL
4	Midline shift >5 mm; no high-density lesion >25 mL
5	Any lesion surgically evacuated or high-density lesion >25 mL
6	Other

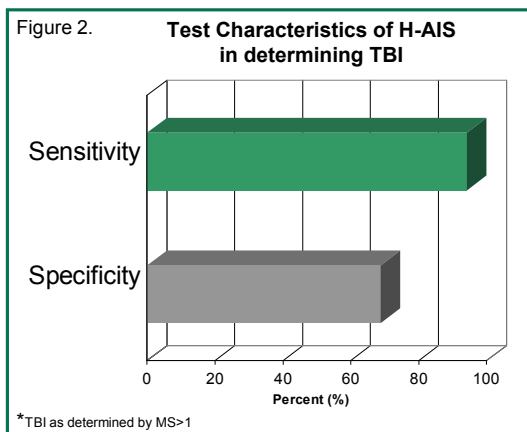
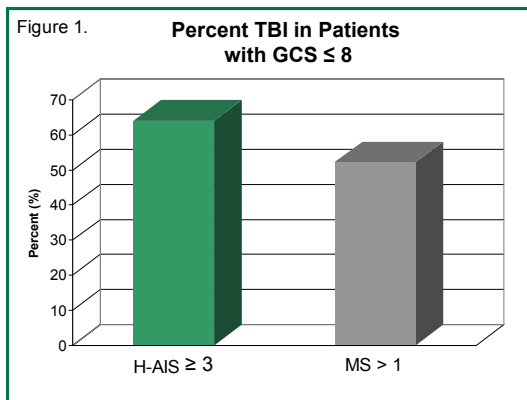
Results

During the study period, 161 patients were admitted with a PH GCS ≤ 8 and sufficient information to assign both MS and H-AIS.

TBI was classified in 84 (52.2%) patients via MS > 1 as compared to 103 (64.0%) patients based on H-AIS ≥ 3 .

The sensitivity of H-AIS ≥ 3 in determining TBI, as defined by a MS > 1 , was 94.1%, while the specificity was determined to be only 68.8%.

This discrepancy indicates that 30% of patients who were found to have no TBI via the MS had an H-AIS ≥ 3 .



Discussion

Although the development of standardized scoring systems to report injury severity has greatly impacted research in the field of injury science, appropriate classification and usage is vital³. While the combination of physiologic and anatomic scoring systems relay improved correlation with survival and functional outcomes, no prior study has investigated the effectiveness of combined GCS and H-AIS in determining TBI^{1, 4}.

As seen in this study, an over estimation of TBI when classified by H-AIS can have significant impact on research studies. If clinical decisions, interventions, and assumptions are made on an inadequately defined population with gross overestimation of TBI, the results will be inaccurate.

Similar to the departure of GCS from its initial purpose, H-AIS has outstretched the boundaries in which it was initially developed. When used as intended, AIS categories have great utility as components of the Injury Severity Score (ISS) and in creating a system for comparisons of injuries and injury severity³. In contrast, when not used as validated, these measures lose their functionality and become unreliable predictors and surrogates as evident in this study.

Conclusion

- H-AIS is an unreliable measure in identifying TBI in patients with PH GCS ≤ 8 .
- Use of H-AIS as a proxy determinant for TBI will result in an overestimation of the incidence and inadequate characterization of the study population. Implications of such measures may greatly influence clinical research.

References

1. Foreman BP, Caesar RR, Parks J, Madden C, Gentilello LM, Shafi S, et al. Usefulness of the abbreviated injury score and the injury severity score in comparison to the Glasgow Coma Scale in predicting outcome after traumatic brain injury. *J Trauma* 2007;62(4):946-50.
2. Marshall LF, Marshall SB, Klauber MR, Van Berkum Clark M, Eisenberg H, Jane JA, et al. The diagnosis of head injury requires a classification based on computed axial tomography. *J Neurotrauma* 1992;9 Suppl 1:S287-92.
3. Linn S. The injury severity score—importance and uses. *Ann Epidemiol* 1995;5(6):440-6.
4. Demetriades D, Kuncir E, Murray J, Velmahos GC, Rhee P, Chan L. Mortality prediction of head Abbreviated Injury Score and Glasgow Coma Scale: analysis of 7,764 head injuries. *J Am Coll Surg* 2004;199(2):216-22.