Meta-analysis of Glasgow Coma Scale and Simplified Motor Score in predicting traumatic brain injury outcomes


CRD summary
The authors concluded that the Simplified Motor Score and Glasgow Coma Scale performed similarly in predicting three traumatic brain injury outcomes. Mortality was better predicted by the Glasgow Coma Scale but the clinical significance was undetermined. This was a generally well-conducted review in terms of methodology; the authors' recommendation for prospective evidence to confirm the findings seems appropriate.

Authors' objectives
To compare the accuracy of the Glasgow Coma Scale with the Simplified Motor Score in predicting outcomes in patients with traumatic brain injury.

Searching
Seven databases including MEDLINE, PsycINFO and EMBASE were searched up to February 2012 without language restrictions. The search strategy was available online. Reference lists of relevant articles and conference proceedings were searched manually.

Study selection
Eligible studies were randomised controlled trials and case control studies that compared the Glasgow Coma Scale with the Simplified Motor Score in predicting outcomes in patients with traumatic brain injury. Eligible studies could be conducted in emergency department (or equivalent) or non-emergency department settings. Primary outcomes were emergency tracheal intubation, clinically significant brain injury, neurosurgical intervention and mortality.

All included studies were conducted in USA. The median age was 32 years and 63.4% of patients were male. Most studies included both adults and children and made the assessment in a trauma centre or emergency department; other inclusion criteria varied across studies. Patients with less severe head injuries were excluded from the analysis.

Two reviewers independently screened studies for inclusion; disagreements were resolved through consensus in the presence of a third reviewer.

Assessment of study quality
Two reviewers independently assessed study quality according to the 14-item Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool. Discrepancies between reviewers were resolved through consensus in the presence of a third reviewer.

Data extraction
The area under the curve (AUC) and 95% confidence intervals were extracted or calculated independently by two reviewers using a standardised form. Discrepancies were resolved through consensus.

Methods of synthesis
The authors used multivariate random-effects meta-analysis using a restricted maximum likelihood algorithm to pool area under the receiver operator characteristic curve data and associated 95% confidence intervals. Data were presented separately for each predictive model, by outcome measure. A test for interaction was performed to assess the difference between pooled AUC estimates for each predictive model.

Statistical heterogeneity was assessed using the $I^2$ statistic ($I^2>50\%$ indicated significant heterogeneity).

Results of the review
Five retrospective studies (102,132 patients) were included in the review. Where reported, follow-up was at hospital discharge or in-hospital death. All studies scored 11.5 on the QUADAS tool; none of the studies ensured that the
reference test was independent of the index test and none reported uninterpretable/intermediate test results.

Statistically significant differences in accuracy between the models for predicting mortality (Glasgow Coma Scale AUC 0.90, 95% CI 0.88 to 0.91, Simplified Motor Score AUC 0.87, 95% CI 0.86 to 0.88; p=0.01) suggested that the Glasgow Coma Scale had higher predictive value.

There were no statistically significant differences in accuracy between the Glasgow Coma Score and Simplified motor Score for predicting clinically significant brain injury (AUC 0.79 versus 0.75), neurosurgical intervention (AUC 0.83 versus 0.81) or emergency tracheal intubation (AUC 0.85 versus 0.82).

Significant statistical heterogeneity was evident for all outcomes.

**Authors' conclusions**

Although the Simplified Motor Score performed similarly to the Glasgow Coma Scale in the prediction of three traumatic brain injury outcomes, mortality was better predicted by the Glasgow Coma Scale. The clinical significance of the small difference between the two scales was undetermined.

**CRD commentary**

The review question and supporting inclusion criteria were clearly stated. There was a satisfactory search of the literature with no language restrictions for published studies. Conference abstracts were sought but it seemed that only those with full papers in PubMed were included and this made it unclear whether unpublished data were included in the review. Each stage of the review was performed in duplicate and this minimised risks of reviewer error and bias. The authors used a quality assessment tool designed for diagnostic accuracy studies. As a result, some criteria were not appropriate for predictive accuracy and some important potential sources of bias were not assessed. All of the studies failed on independence of the reference standard and the index test.

A large number of patients were included in the review. All the studies were retrospective (which have inherent limitations). There was evidence of statistical heterogeneity and there was clinical heterogeneity in definitions used to assess outcomes and inclusion criteria of the studies. Details of the data extraction process were limited. Although area under the curve data provide an indication of overall accuracy, the relationship between sensitivity and specificity (and therefore numbers of false positives and false negatives) remains unknown; the relative abilities of tests to rule in or out could impact on decision-making in clinical practice. Given the information supplied, it seems possible that 2x2 tables of test performance could have been derived from the studies. In which case, summary estimates of sensitivity and specificity (along with likelihood ratios and diagnostic odds ratios) could have been calculated, giving a more in depth understanding of the predictive accuracy of the tests.

This was a generally well-conducted review in terms of methodology and the authors' conclusions reflect the evidence presented. The authors acknowledged that the small difference between the two scales for predicting mortality may not be clinically significant and that the evidence from retrospective studies needs to be confirmed using prospective study designs.

**Implications of the review for practice and research**

**Practice:** The authors stated that the scales are useful only for patients with severe head injuries.

**Research:** The authors stated that prospective studies were needed to assess the test performance of the Simplified Motor Score compared to Glasgow Coma Scale, particularly in patients with milder brain injuries (which are more common).

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Not stated.

**Bibliographic details**

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.