

**Critical Review Form
Clinical Decision Rule**

PGY-3

[Nickoles TA, Eubanks JW 3rd, Lewit RA, et al. The A+ criteria for pediatric blunt cerebrovascular injury: An ATOMAC+ multicenter study. J Trauma Acute Care Surg. 2025 Sep 1;99\(3\):404-411.](#)

Objectives: This study aimed to identify "common risk factors for BCVI [blunt cerebrovascular injury] among a multicenter cohort of pediatric trauma centers within the ATOMAC+ Pediatric Trauma Research Network (APTRN) and derived a new set of screening criteria." (p. 404)

Methods: This was a preplanned secondary analysis of a prospective, multi-institutional observational cohort study conducted at six American College of Surgeons–verified level 1 pediatric trauma centers within the [ATOMAC+ \(A+ Pediatric Trauma Research Network\) collaborative](#), with data collected from 2017 to 2020. Children younger than 15 years who sustained blunt traumatic injury to the head, face, or neck ([Abbreviated Injury Score \[AIS\]](#) > 0 in any of these regions) were prospectively identified and screened for BCVI within a day of admission using the [Memphis screening criteria](#) (cervical spine fracture/ligamentous injury, unexplained neurological exam findings, Horner's syndrome, Le Fort II/III facial fractures, skull base fractures, or neck soft tissue injury). Patients meeting Memphis criteria underwent CT angiography of the head and neck. Patients with penetrating injuries were excluded. All surviving patients received follow-up evaluation at 2 weeks post-discharge (via medical records, clinic notes, or phone call) to assess for neurological sequelae; BCVI diagnosis was confirmed by angiography at initial hospitalization or by symptoms and subsequent angiography at follow-up. Patients without follow-up or with missing outcome data were excluded from the primary analysis.

Univariate logistic regression assessed the association between individual patient/injury variables and BCVI, with odds ratios and 95% CIs calculated. Variables significant at $p < 0.05$ with high odds ratios were entered into a multivariable logistic regression model using backward selection to derive a final set of independent predictors, which were then used to construct the proposed "A+" screening criteria.

Of 2,283 patients enrolled across the six centers, 1,327 (58.1%) had adequate follow-up (2-week follow-up in 1,267, 6-month follow-up in 3, and death prior to follow-up in 57) and were included in the analysis; 54 patients (2.4%) were excluded for missing outcome data. Excluded patients were more likely to have minor injuries, higher initial GCS, survive, be discharged home, be White, and have lower-energy mechanisms compared to included patients.

Critical Review Form: Clinical Prediction / Decision Rule

Guide

Comments

Is this a newly derived instrument (Level IV)?

Was validation restricted to the retrospective use of statistical techniques on the original database? (If so, this is a Level IV rule & is not ready for clinical application).	N/A. This was a derivation study only. No validation was performed in this study. This is therefore a Level 4 clinical decision rule .
Were all important predictors included in the derivation process?	Yes. The authors included a wide array of predictors for inclusion, including age, mechanism of injury, associated injuries, types of skull fracture, spine injuries at varying levels, facial fracture types, and brain injury types.
Were all important predictors present in significant proportion of the study population?	Mostly yes. There were some factors (such as mastoid ecchymosis and fractures at higher cervical levels) that were only present in a small number of subjects (<10). Some of these factors did end up in the clinical screening tool.
Does the rule make clinical sense?	Yes. The tool includes high cervical fractures, key fractures of the skull and face, and ligamentous spinal cord injury, which clinical gestalt suggest would be associated with injury to the key vascular structures in the anterior and posterior neck.

Has the instrument been validated? (Level II or III). If so, consider the following:

Did validation include prospective studies on several different populations from that used to derive it (II) or was it restricted to a single population (III)?	N/A. No validation performed.
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How well did the derivation/validation study meet the following criteria?

Did the patients represent a wide spectrum of severity of disease?	Presumably yes. This was a large cohort of patients with blunt traumatic injury to the head, face, or neck. The incidence of BSCI was quite low, occurring in only 1.8% of the cohort.
Was there a blinded assessment of the gold standard?	No. There was no single " gold standard " as the outcome of interest was BSCI. Clinicians would have been aware of the clinical condition of each patient but would not have been aware of the components of the screening tool.
Was there an explicit and accurate interpretation of the predictor variables & the actual rule without knowledge of the outcome?	Yes. Predictor variables were recorded prospectively in the database without knowledge of the presence or absence of BSCI.
Did the results of the assessment of the variables or of the rule influence the decision to perform the gold standard?	Yes. While the rule was not known at the time of patient care, the presence or absence of various injuries would certainly have influenced testing performed at the time of care.
How powerful is the rule (in terms of sensitivity & specificity; likelihood ratios; proportions with alternative outcomes; or relative risks or absolute outcome rates)?	- The overall incidence of BSCI in the analyzed cohort was 1.8% (24/1,327). - Patients with BSCI had significantly higher mortality (25.0% vs. 4.1%, $p < 0.0001$) and stroke incidence (20.8% vs. 2.5%, $p < 0.0001$) than those without BSCI. - On univariate analysis, basilar skull fractures (particularly with carotid canal involvement, OR 64.1), upper cervical spine injuries (C1–4 fractures, subluxation, or ligamentous injury), several craniomaxillofacial fractures, and GCS ≤ 8 were significantly associated with BSCI. - Multivariable analysis identified five independent predictors: temporal fracture (OR 8.86), sphenoid fracture (OR 3.95), orbital roof fracture (OR 4.39), C1–4 fracture (OR 38.93), and cervical

	ligamentous injury (OR 6.36) — together forming the proposed "A+" screening criteria. • Only 2 of 24 BCVI cases did not meet any of the five A+ criteria. ○ The sensitivity of this rule was 91.7% in this cohort. ○ Insufficient information was provided to calculate the specificity. • Several previously proposed risk factors (mandible fracture, neck soft tissue injury, hanging mechanism, Horner's syndrome, unexplained neurological exam findings) were not significantly associated with BCVI in this cohort. • Being properly restrained during a motor vehicle collision was negatively associated with BCVI, consistent with prior literature.
Has an impact analysis demonstrated change in clinical behavior or patient outcomes as a result of using the instrument (Level I)? If so, consider the following:	
How well did the study guard against bias in terms of differences at the start (concealed randomization, adjustment in analysis) or as the study proceeded (blinding, co-intervention, loss to follow-up)?	Somewhat well. This was a retrospective derivation of a clinical screening tool based on prospectively collected. It would not have been feasible to blind clinicians to the presence of absence of various predictor variables, but clinicians would not have been aware of the components of the screening tool.
What was the impact on clinician behavior and patient-important outcomes?	N/A

Limitations:

1. This was purely a derivation study, and this clinical decision rule has not been validated. This is therefore a [Level 4 clinical decision rule](#) and not ready for use based on this paper alone.
2. Of 2,283 patients enrolled, only 1,327 (58.1%) had adequate follow-up and were included in the final analysis.
3. The authors report a high sensitivity and specificity for the screening criteria, but at no point do they specify the values of these test characteristics; the actual sensitivity was 91.7% and insufficient information was provided to calculate the specificity.

Bottom Line:

This multicenter, secondary analysis of prospectively collected data involving 1,327 pediatric blunt trauma patients with head, face, or neck injury found an overall BCVI incidence of 1.8%, with BCVI strongly associated with higher mortality and stroke risk. Multivariable analysis identified five independent predictors — temporal, sphenoid, and orbital roof fractures, plus C1–4 fractures and cervical ligamentous injury — which the authors combined into a proposed "A+" screening criteria with a sensitivity of 91.7%.