

Prognosis Following Mild Head Injury in Children

JOHN R. McCONAGHY, MD, and ALOIYA R. EARL, MD
The Ohio State University Wexner Medical Center, Columbus, Ohio

This guide is one in a series that offers evidence-based tools to assist family physicians in improving their decision making at the point of care.

This series is coordinated by Mark H. Ebell, MD, MS, Deputy Editor.

A collection of Point-of-Care Guides published in *AFP* is available at <http://www.aafp.org/afp/poc>.

CME This clinical content conforms to AAFP criteria for continuing medical education (CME). See CME Quiz Questions on page 968.

Author disclosure: No relevant financial affiliations.

Clinical Question

Can a clinical decision tool predict the likelihood of persistent postconcussion symptoms, thus offering anticipatory guidance for the treatment of children with concussion?

Evidence Summary

Concussion, also referred to as mild traumatic brain injury, is a common injury in children.¹ It is defined as a transient disturbance in mental status following head trauma, and it can cause a variety of physical, cognitive, and emotional sequelae.² Symptoms continuing for more than 28 days after the initial trauma are referred to as persistent postconcussion symptoms and affect approximately one-third of children with concussion.³ Examples of persistent postconcussion symptoms include headache, fatigue, inattentiveness, and forgetfulness. These symptoms can adversely impact patients' schoolwork, sports participation, and quality of life.⁴ It is therefore important for clinicians to counsel children and their caregivers about the possibility of persistent symptoms after an acute concussion. Using a decision tool can help identify children at higher risk.

The Post-Concussion Symptom Scale was developed and validated for the clinical assessment of concussed athletes seven to 26 years of age to determine the risk of ongoing symptoms.⁵ Patients use a Likert scale to grade the severity of 22 possible symptoms, and are classified as less likely or more likely to experience persistent postconcussion symptoms based on their score. Although the scale is comprehensive and measures symptom severity, it is time-consuming to administer and not practical in an acute or office setting.

The Predicting and Preventing Postconcussive Problems in Pediatrics study is a

prospective, multicenter cohort study of 3,063 children five to 17 years of age who have an acute head injury.⁶ Baseline data were collected on the children's neurologic, developmental, and psychiatric histories and their presentation and symptoms in the emergency department. Electronic follow-up surveys were given 28 days after the injury. The primary outcome was three or more new or worsening symptoms, compared with before the injury, using a self-reported symptom inventory. The 12-point risk score derived and validated in this study (*Table 1*) was designed to be used within 48 hours of an acute head injury and uses nine independent predictors at initial presentation to stratify the risk of subsequent persistent postconcussion symptoms as low, medium, or high.⁶ The negative likelihood ratio is 0.36 (95% confidence interval [CI], 0.23 to 0.58) for the low-risk group, and the positive likelihood ratio is 3.00 (95% CI, 2.06 to 4.37) for the high-risk group.

Although its use needs to be studied in the primary care setting, this risk score can be a starting point for discussing the likelihood of persistent postconcussion symptoms with patients. Further research is needed on whether this information can be used for interventions that can impact important long-term outcomes, such as school performance and quality of life.

Applying the Evidence

A 16-year-old male linebacker presents one day after having a helmet-to-helmet collision during a football game. He was confused for about 30 seconds after the injury. On presentation, he reports headache and fatigue. He has no history of concussion or migraine. He is slow to answer your questions. He has two errors with tandem stance testing. The

remainder of his examination, including his neurologic assessment, is normal. What is his risk of developing persistent postconcussion symptoms?

Answer: Using the clinical decision rule, this patient has a score of 6, which places him at medium risk. You should discuss with him and his caregivers that he has a 30% estimated risk of developing persistent postconcussion symptoms more than a month after his injury. These symptoms may impact return to play or may become long-term issues that negatively impact quality of life. Follow-up should be arranged to foster a supportive environment for the patient's transition back to school and sports when clinically indicated.

Address correspondence to John R. McConaghy, MD, at john.mcconaghy@osumc.edu. Reprints are not available from the authors.

REFERENCES

1. Faul M, Xu L, Wald MM, Coronado VG. Traumatic brain injury in the United States. Emergency department visits, hospitalizations and deaths 2002–2006. https://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf. Accessed September 27, 2016.
2. McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. *Br J Sports Med*. 2013;47(5):250-258.
3. Babcock L, Byczkowski T, Wade SL, Ho M, Mookerjee S, Bazarian JJ. Predicting postconcussion syndrome after mild traumatic brain injury in children and adolescents who present to the emergency department. *JAMA Pediatr*. 2013;167(2):156-161.
4. Yeates KO, Kaizar E, Rusin J, et al. Reliable change in postconcussive symptoms and its functional consequences among children with mild traumatic brain injury. *Arch Pediatr Adolesc Med*. 2012;166(7):615-622.
5. Meehan WP, Mannix R, Monuteaux MC, Stein CJ, Bachur RG. Early symptom burden predicts recovery

after sport-related concussion. *Neurology*. 2014;83(24):2204-2210.

6. Zemek R, Barrowman N, Freedman SB, et al.; Pediatric Emergency Research Canada (PERC) Concussion Team. Clinical risk score for persistent postconcussion symptoms among children with acute concussion in the ED [published correction appears in *JAMA*. 2016;315(23):2624]. *JAMA*. 2016;315(10):1014-1025. ■

Table 1. Clinical Decision Tool to Predict the Risk of Persistent Postconcussion Symptoms in Children 5 to 17 Years of Age

Sign or symptom	Points	
Age		
8 to 12 years	1	
13 to 17 years	2	
Female sex	2	
Fatigue	2	
Prior concussion with symptom duration of one week or more	1	
Four or more errors on the tandem stance test*	1	
History of physician-diagnosed migraine	1	
Answering questions slowly	1	
Headache	1	
Sensitivity to noise	1	
Total score: _____		
<i>Risk category</i>	<i>Score</i>	<i>Estimated risk (range based on points within risk category)</i>
Low	0 to 3 points	10.5% (4.1% to 11.8%)
Medium	4 to 8 points	30.4% (16.4% to 47.6%)
High	9 to 12 points	61.7% (57.1% to 80.8%)

*—For the tandem stance test, patients are instructed to stand heel to toe with the nondominant foot in the back for 20 seconds with their hands on their hips and eyes closed. An error is moving out of this position to regain balance indicating impaired postural stability.

Information from reference 6.