

COMMENTARY

Time to Change from a Symptom-based Concussion Assessment to a Structured Physical Examination

We are pleased to write this editorial on concussion assessment for this issue of *Academic Emergency Medicine*. The request was based on the publication of the article by Subbian et al. on the evaluation of patients with mild traumatic brain injury (mTBI) in the emergency department (ED). This Cincinnati-based group describes a robotic device that objectively assesses upper-extremity motor and proprioceptive performance. The results of the study indicate that impaired motor and proprioceptive performance are associated with delayed recovery from concussion.

Our research has focused on physiological aspects of concussion and mTBI^{1,2} and therefore we were not surprised by the results from the Cincinnati group. Our research and that of others has identified a number of important physiological aspects of concussion, including dysregulation of the autonomic nervous system³ and disruption of the autoregulatory control of cerebral blood flow.⁴ We have demonstrated that concussed patients have a variety of physiological irregularities that are most evident during exercise.^{2,4-6} It is probably not realistic nor is it recommended to assess concussed patients on a treadmill in the ED; however, our research suggests that many signs of concussion can be revealed through a focused physical examination, with or without a robotic device.

The standard of care in the ED has been a symptom-based evaluation and decisions around imaging. The American College of Emergency Medicine provided very specific advice about the use of CT and MRI in 2008⁷ and while it may be time to revisit the guidelines due to recent advances in imaging, these guidelines have provided sound advice for decision making for years. The Centers for Disease Control and Prevention published ED guidelines for the evaluation of the concussed patient in 2006 (the "Acute Concussion Evaluation" [ACE]). The ACE includes a symptom scale and asks a series of questions about loss of consciousness

and amnesia. The format and information gathered was current for its time but is due for an overhaul. The ACE does not include a physical examination of concussed patients.

While the Cincinnati group identified that poor motor performance in the ED predicted delayed recovery from concussion, they did not examine for ocular dysfunction, vestibular dysfunction, or cervical injury, which we now know often accompany concussion.^{8,9} We recently completed a study with acutely concussed adolescents and compared their physical examination findings with adolescents that did not have an injury. Physical findings in concussed patients included cervical tenderness, abnormal oculomotor performance (e.g., abnormal smooth pursuits, convergence insufficiency and/or symptomatic saccades), signs of vestibular dysfunction (abnormal vestibular ocular reflex [VOR] and/or dizziness during the VOR), and abnormal tandem gait. Consistent with cardiovascular autonomic dysfunction reported in mTBI patients,¹⁰ some concussed adolescents experienced lightheadedness upon standing accompanied by an orthostatic drop in systolic blood pressure and/or rise in heart rate, which we interpret to be a physiological sign of concussion.

Similar to the approach of Mucha et al.,¹¹ when conducting the physical examination we assess whether the concussed patient experiences new symptoms or symptom exacerbation. For example, a patient may demonstrate normal oculomotor function while tracking the examiner's finger across the visual field but complain of dizziness or increased headache, which is an abnormal response. We have since prepared a written guideline for a physical examination of the concussed patient that can be performed by the doctor in less than 10 minutes.¹² You can think of the current editorial as a preview of our recommended physical examination, albeit with much less detail.

The advantage of a physical examination in the ED is the quality of advice that can be provided to the patient or the patient's family. Prudent advice includes avoiding situations that risk further injury (in sport or occupation),¹³ several days of rest,¹⁴ and extra sensitivity to worsening symptoms (as per Jagoda et al.⁷). A neurologically based simple physical examination allows the ED physician to advise the patient to pursue certain

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avenues with their general practitioner/pediatrician. If neck injury is suspected, the patient can be advised to have their doctor examine the neck further and consider a physical therapy consult. The same holds true for oculomotor irregularities and signs of vestibular dysfunction. Concussions associated with cervical, oculomotor, and/or vestibular problems may herald a longer recovery time and so early identification can lead to timely intervention and may speed recovery.¹⁵

We heartily recommend a movement away from symptom-based assessments to a physical examination-based evaluation of concussed patients in the ED. The physical examination elements are all quite familiar to physicians; using them merely requires a change in mindset. Concussion is a medical phenomenon characterized by physiological changes and dysfunction of certain neurological systems that can be straightforwardly examined by a medical doctor. And while technology is advancing the practice of medicine in many areas, we are not at the point of having to enlist robots to perform the physical examination doctors learned in medical school.

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