Sports-Related Traumatic Brain Injury

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KEYWORDS

• Sports-related • Mild traumatic brain injury • MTBI • Mild TBI guidelines
• Sideline Concussion Assessment Tool 3 (SCAT3) • Postconcussive syndrome

KEY POINTS

- The term *concussion* has been supplanted by the term *mild traumatic brain injury* (MTBI), but the two are still used interchangeably.
- The definition for MTBI is a "complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head."
- SCAT3 is common sideline assessment tool.
- Any one symptom or sign of concussion should prompt removal of the athlete from play for the remainder of the event.
- Neuroimaging is rarely necessary for the diagnosis of concussion.

INTRODUCTION

In his work on the gladiator games of the Roman Empire, Galen (129–216/217 AD) documented sports-related traumatic brain injuries (TBI).[1] In the present day, concussions have garnered more attention in the medical literature, media, and social media. Therefore, in the nomenclature according to the Centers for Disease Control and Prevention, "Facts for Physicians" the term *concussion* has been supplanted by the term *mild TBI* (MTBI).[2] And MTBI is defined as a "complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head." Current numbers indicate that 1.7 million are documented TBIs annually, with estimates around 3 million annually (173,285 sports- and recreation-related TBIs among children and adolescents). The Sideline Concussion Assessment Tool 3 (SCAT3) and the NFL Sideline Concussion Assessment Tool are commonly used sideline tools.

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MANAGEMENT GOALS

Management of concussion in sport consists of several phases:

- Evaluation of airway, breathing, and cardiovascular function
- Evaluation of the cervical spine
  - Immobilization and transfer to an appropriate trauma center is necessary if cervical spine injury is suspected
- Evaluation for signs of rapidly worsening mental status
  - Focal neurologic findings, including abnormal pupillary response, abnormal extraocular movements, and abnormal motor or sensory functions should be ruled out
  - Immediate transfer to an appropriate trauma center with neuroimaging capabilities is indicated for any signs of neurologic deterioration

Neuroimaging is rarely necessary for the diagnosis of MTBI.[3,4] It should be considered to rule out any more serious brain injury or skull fracture. Computed tomography can be used in an acute setting when focal symptoms are noted to rule out mass effect. It is also the best tool when skull fracture is considered. MRI may also be considered in the evaluation of persistent symptoms that do not resolve as expected.

See **Box 1** for goals of concussion management.

SIDELINE MANAGEMENT

After serious cervical spine or brain injury is ruled out, further evaluation can commence. All athletes with suspected brain injury should be removed from competition until evaluated by a licensed health care provider with experience in the evaluation of MTBIs.[3,4] Current guidelines recommend the use of a standardized sideline tool in evaluating an athlete with a suspected MTBI.[3] Several sideline tools are available for the management of MTBI. The most commonly used tools currently available combine health history with testing of cognition and assessment of balance. Balance testing most commonly used is based on the Balance Error Scoring System (BESS). BESS is a 5-minute test using 3 standing positions (double leg stance, single leg stance, and tandem stance) to evaluate balance on multiple surfaces.[3] The BESS is 34% sensitive and 94% specific in predicting concussion.[3]

Current sideline tools use Modified BESS testing, which tests same standing positions but on a firm surface only - no studies have shown its sensitivity or specificity.[3,5] The Sideline Concussion Assessment Tool 3 (SCAT3) and the NFL Sideline Concussion Assessment Tool are commonly used sideline tools.[3,6] The SCAT3 was recently updated from the SCAT2 to include questions about relevant history, including history of migraine headache, attention-deficit/hyperactivity disorder, depression, and anxiety and an inquiry about current medications.[3] The SCAT3 is normed for all individuals

Box 1
Concussion management goals

Initial evaluation and diagnosis

Postinjury evaluation

Symptom management

Safe return to participation