Concussion and Trauma in Young Athletes: Prevention, Treatment, and Return-to-Play

Rance McClain, DO

KEYWORDS

• Athlete • Concussion • Mild traumatic brain injury • Second impact syndrome
• Computerized neurocognitive assessment

KEY POINTS

- Relative risk of suffering concussion/mild traumatic brain injury in youth sports participation.
- Proper initial assessment of youth athletes suspected of suffering a concussion.
- The common symptoms during the postconcussion period.
- The proper method of determining an athlete's return-to-play status.
- Second impact syndrome and how can people minimize the risk of an athlete suffering a second impact injury.

Millions of school-aged children participate in sports activities annually. Athletes and parents understand that injuries can, and do, occur during sports participation. However, neither group often considers the risk of serious injury when participating in athletic competitions and practices. In 2012, over 1.35 million children under the age of 19 were taken to the emergency room for injuries that occurred during participation in athletic events.[1] In the last few years there has been a growing awareness and interest in 1 sports injury in particular. At the forefront of public awareness is the issue of concussion, which is considered a subset of traumatic brain injury (TBI). The definition, in its most recent form, was updated at the 4th International Conference on Concussion in Sport held in Zurich, Switzerland in 2012 (**Box 1**).[2]

Neither I, nor my spouse, received anything of benefit from the production of this material from any commercial or business entity.
Kansas City University of Medicine and Biosciences, College of Osteopathic Medicine, 1750 Independence Avenue, Kansas City, MO 64106, USA
E-mail address: rmcclain@kcumb.edu

Prim Care Clin Office Pract 42 (2015) 77–83
http://dx.doi.org/10.1016/j.pop.2014.09.005 **primarycare.theclinics.com**
0095-4543/15/$ – see front matter

Box 1
Consensus statement on concussion in sports

Concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic, and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury.

1. Concussion may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an"impulsive' force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However, in some cases, symptoms and signs may evolve over a number of minutes to hours.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged.

From McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport, Zurich, November 2012. J Athl Train 2013;48(4):555; with permission.

Concussions occur on a daily basis in youth athletics. From 2001 to 2009, annual emergency department visits for TBI increased in number from 153,375 to 248,418, with the highest rates among males ages 10 to 19 years.[3] Within this age group, nearly half (47%) of the concussions occurred in the 12- to 15-year-old age group subset.[1] This is occurring in spite of continued advances in athletic equipment and new measures to ensure increased safety of youth sports participants.

Awareness of head injuries and concussions is increasing in the United States, most likely due to a combination of coverage of this topic in mass media and aggressive awareness campaigns by organizations such as the Centers for Disease Control and Prevention (CDC), the National Football League (NFL) and USA Football. Programs developed and supported by these organizations, such as "Heads Up Football,"[4] are making a concerted effort to make the public aware of methods to reduce the risk of youth participants sustaining concussions during participation.

Efforts within each state have also occurred because of enactment of the Lystedt Laws.[5] These bills have been enacted as a follow-up to the state of Washington putting a bill in place in 2009 to protect young athletes from life-threatening or potentially lifelong consequences of returning to play too soon after sustaining a head injury. As of February 2014, all 50 states have put a similar law in place.[5] The original Lystedt Law was done in honor of Zackery Lystedt, a 13-year-old middle school football player who suffered permanent brain injury when he returned to play after suffering a concussion.[5]

The initial step in caring for concussed athletes is to develop an emergency action plan that includes a concussion protocol, which consists of recognition of injury, assessment, disposition, follow-up, return to play (RTP), and education.[6] Education efforts should include all persons around an athlete's participation such as the athletes themselves, their coaches, their parents, and the team trainers or physicians if available for the school or league.

Recognition of concussion can be complicated by the fact that many symptoms are not specific to concussion. The most common symptom, a headache, has many