Concussions, or mild traumatic brain injuries, specifically sports related mild traumatic brain injuries have received a great deal of media and medical attention in the past several years. Steady progress has been made in regards to understanding of pathophysiology, creation of tools for symptom quantification and understanding the recovery/sequelae from concussions. Despite this progress, definitive pathophysiological understanding and concussion treatment - prevention consensus remains a dynamic and challenging entity due to the variability of the injury.

What is a concussion? (Zurich, 2008)

- A complex pathophysiological process that affects the brain, induced by traumatic biomechanical forces.
- No abnormality on standard structural neuroimaging (CT or MRI).
- Can be caused by blow to the head or ANY part of the body with an impulsive force transmitted to the head.
- Typically results in rapid onset of short lived impairment with complete resolution if properly managed.
- May or may not include loss of consciousness.
- Acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.

Symptoms of a concussion can include but are not limited to:

- Headache
- Dizziness
- Vertigo
- Emotional liability
- Memory impairment
- Fatigue
- Sleep impairment
• Anxious
• Concentration impairment
• Balance problems
• Confusion
• Sadness

How should I “refer to the injury”?
1. Concussions are injuries to the brain. They are not a “transient loss of blood flow” or “just part of the game.”

2. They should not be dismissed as “ding” injuries.
   • “Ding” or formally graded Grade 1 injuries resulted in neurocognitive deficits 36 hours after injury (Lovell et al., 2004).

Accurately predicting the severity of injury at the time of the injury is currently impossible.
   • Always focus attention on recovery of signs and symptoms, neuropsychological testing and balance.

Prevalence
• 1.6 to 3.8 million sports-related TBIs occur each year (Langlois et al, 2006).
• Concussion accounts for 6-10% of all sport related injuries.
  • Higher risk among high school athletes compared to collegiate and professional athletes.
  • Higher risk among athletes in contact sports.

Acute management of a concussion
Management of a concussion starts with a proper diagnosis. This is most adequately obtained with proper, careful observation of athletes. Rule out associated injury including cervical spine injuries, shoulder injuries and transient neuropraxia (stingers). A neurological exam including balance and symptom reporting is strongly recommended. Consider the use of the SCAT2: http://www.sportconcussions.com/html/SCAT2.pdf.

If a concussion is suspected, game removal is mandatory with NO SAME DAY RETURN TO PLAY.

Assessment tools
One of the largest highlights of the 3rd International Conference on Concussion in Sport was ongoing development of a standardized concussion assessment tool. The formalization of the SCAT2 (Sport Concussion Assessment Tool) has been widely adopted by many organizations as an important objective measure commonly used by health care providers in the field, as well as clinic settings to help establish a diagnosis and to track concussion symptoms.

Due to the subjective nature of many concussion symptoms, many health care providers use the symptom evaluation portion of the SCAT2, commonly referred to
the PCSS (Post Concussion Symptom Score), to help follow a concussion treatment program, and to guide a focused rehabilitation program that is tailored to those athletes’ predominant symptoms.

**State Legislation in regards to return to play decisions**
The Minnesota legislature has passed a law regarding assessment and treatment of concussions in student athletes. It was **signed into law by Governor Dayton on May 27, 2011**. Highlights include:

- Requires organizations provide information about concussions to coaches, officials, youth athletes and parents.
- Requires all coaches and officials to receive annual concussion training.
- Require the youth athlete and their parent or guardian to sign a concussion information form before participating in the athletic activity.
- A coach or official must remove a youth athlete from the athletic activity if the youth athlete exhibits signs, symptoms, or behaviors consistent with a concussion or is suspected of sustaining a concussion.
- Return to play once he/she is evaluated by a trained provider and the provider gives them written permission to return to the activity.

**Neurocognitive testing**
Neuropsychological/neurocognitive testing is and has been the gold standard for brain function. For over two decades, computerized neuropsychological testing has been used more and more frequently to help quantify cognitive functioning and performance.

- Only part of the information used to help guide a return to play decision.
- Computerized testing is a screening and at times a full traditional (pen and paper test) is used; it is performed by a neuropsychologist in more complex cases.
- Not an IQ test.
- Many high risk athletes are using baseline neurocognitive tests to help health professionals follow concussion recovery and to help evaluate subclinical signs and symptoms of a concussion.

Neurocognitive tests are also helpful at individualizing a rehabilitation program for athletes based on his or her impairments to help maximize cognitive rest and cognitive rehabilitation.

Examples of condensed, commonly computerized, neurocognitive testing to help guide a return to play decision include CogState, Impact and Headminder.

**Treatment of a concussion.**
The hallmark of concussion treatment remains relative cognitive rest. Depending on the severity of the athlete’s symptoms, this may include absence for school, absence from extracurricular activities and/or social engagements. Calculation of the athlete’s relative cognitive stimulation should be done on an individual basis, keeping in mind many things in daily life are very stimulating and can cause significant exacerbation of symptoms, e.g. texting, video games, movies, social engagements.
Return to full time and full exertion, which may or may not include full contact activities, is done in a step-wise manner with careful monitoring of the athletes symptoms with each step and increase of both physical and cognitive stimulation. Only when that athlete demonstrates resolution, and in some cases stability, in his/her symptoms can an unrestricted return to sport commence.

**CTE (Chronic traumatic encephalopathy).**
Chronic traumatic encephalopathy is defined as a progressive neurodegenerative syndrome caused by single, episodic or repetitive blunt force impacts to the head and transfer of acceleration-deceleration forces to the brain. CTE presents clinically after a prolonged latent period as a composite syndrome of mood disorders, neuropsychiatric and cognitive impairment.

- First case was Mike Webster, former offensive lineman for the Pittsburgh Steelers.
- Most feared long term sequelae of repetitive concussions OR SUBCLINICAL head trauma.
- Continues to have ongoing research from multiple academic centers.

**References:**


**Questions and Additional Information:** Please reply to this e-mail, and your questions(s) will be directed to the author of this Matthew Hofkens, D.O.

*Pearls of Knowledge Archive*

All Pearl recommendations are consistent with professional society guidelines, and reviewed by HealthPartners Physician Leadership.