Sports Injuries, Traumatic Brain injury and Chronic Traumatic Encephalopathy

In Concussion in Sports and Recreation, Seminars in Neurology, volume 20, no.2 in 2000, Dr James Kelly stated that according to The Centers for Disease Control, more than 800 sports related concussions occur in the United States each day, sometimes involving high profile athletes, far more amateur and school athletes. That translates to 292,000 sports related concussions annually. More recent data found in a variety of articles and studies published between 2010 and 2013 state that anywhere from 1.6 to 3.8 million sports related concussions per year occur in the US. That translates to over 4,000 sports related concussion each day.

What is the definition of concussion? A concussion is a mild traumatic brain injury (TBI). Presently there is no single definition of concussion or mild TBI that is universally accepted. Concussion definitions include: A type of TBI, caused by a bump, blow, or jolt to the head that can change the way your brain normally works. Concussions can also occur from a fall or a blow to the body that causes the head and brain to move quickly back and forth. Another definition describes concussion an alteration in mental status caused by biomechanical forces that may cause unconsciousness. Health care professionals may describe a concussion as a "mild" brain injury because concussions are usually not life-threatening. Even so, their effects can be serious.

The World Health Organization is developing a new definition, which will hopefully be used by multiple groups of experts. They have created a specific Sport Definition of Concussion as brain injury better 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 include:

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 neurological 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.
4. 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.
5. 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.

The new guidelines to grade concussions have been set by the **American Academy of Neurology** (AAN) and are based on the guidelines set forth by the Colorado Medical Society:

Grade I: The concussion is associated with no loss of consciousness and confusion symptoms lasting less than 15 minutes.

Grade II: These concussions are the same only the confusion symptoms last longer than 15 minutes.

Grade III: Concussions are divided into subcategories, **IIIa** with loss of consciousness measured in seconds and **IIIb** with loss of consciousness measured in minutes.

Permanent brain injuries can occur with Grade II or Grade III concussions.

Colorado Medical Society guidelines for when the athlete may return to play:

Grade	First Concussion	Subsequent Concussions
I	15 minutes	1 week
II	1 week	2 weeks with physician approval
IIIa **(unconscious for minutes)**	1 month	6 months with physician approval
IIIb **(unconscious for minutes)**	6 months	1 year with physician approval

Long Term Effects

Second Impact Syndrome (SIS): Returning to play too soon puts the athlete at risk for this very rare condition in which a second concussion occurs before a first concussion has properly healed, causing rapid and severe brain swelling and often life threatening results. SIS can result from even a very mild concussion that occurs days or weeks after the initial concussion, even if the second injury was far less intense. Most cases of second impact syndrome have occurred in young athletes, particularly those who participate in sports including boxing, baseball, football, hockey, and skiing. An athlete who has suffered a concussion should not return to their sport or any other activity that may put them at risk for another concussion until the symptoms of the initial head injury are entirely gone.

Signs of concussion include the following:

- Disorientation
- Vomiting
- Headache
- Fatigue
- Nausea
- Temporary loss of consciousness

- Confusion or feeling as if in a fog
- Ringing in the ears
- Slurred speech
- Sleep disturbances
- Concentration or memory problems
- Irritability and other personality changes

Epilepsy: Post-traumatic seizures are seizures that result from TBI, and may be a risk factor for post-traumatic epilepsy (PTE), but a person who has a seizure or seizures acutely due to TBI does not necessarily have PTE. A person who has had a concussion doubles their risk of developing epilepsy within the first five years after the injury. Head trauma has been a well identified cause for patients to develop epilepsy. Many studies suggest that TBI is the precipitating cause of epilepsy in as many as 5-6% of patients. Epilepsy does not usually develop immediately after the head injury, rather taking months, or even years, for recurrent seizures to occur.

Parkinson's Disease: Several studies have found a positive correlation between head injury and Parkinson's disease. A study performed by the Mayo Clinic found that those suffering head trauma are 4 to 11 times more likely to develop Parkinson's, depending on the severity of the trauma. Trauma to the head, neck, and cervical spine, through concussion or whiplash, injuries that may be seen secondary to a cross punch in boxing, or slamming into the boards in ice hockey for example, contributes to the damage of the substantia nigra cells.

Alzheimer's Disease: Researchers from the University of Pittsburgh School of Medicine studied a group of patients who suffered concussions to determine which ones experienced the most severe symptoms. It was found that those who experienced mild TBI, concussion, after a blow to the head or a fall had brains that looked similar to those of Alzheimer's patients.
The latest study, published in the Journal of Radiology, looked at 64 patients who experienced concussions and compared their MRI brain scans a year after their injury to those of 15 healthy patients over the same time period. The scans revealed that the damage to the white matter in the concussion patients was similar to that of Alzheimer's patients, whose nerves gradually died after being strangled by expanding plaques of amyloid proteins.
Three or more concussions can cause a person, particularly an athlete, to be five times more likely to suffer from early-onset Alzheimer's disease.

Dementia: There is a very strong link between concussions and dementia. Research seems to indicate that more than one concussion can cause a person to have early onset dementia and other similar disorders.

Chroninc Traumatic Encephalopathy (CTE): Recent research on the pathology of brains, conducted by the Boston University Center, suggests that over time a high level of exposure to intense physical contact can cause permanent brain damage. Potential risks include CTE, which can cause depression and has recently been cited as a cause for suicide in older athletes.

The sum of $765 million is a lot of money. That's the amount that the National Football League has agreed to pay to settle a lawsuit that was brought by more than 4,000 retired professional players who have been diagnosed with advanced dementia and other neurological problems. The lawsuit also includes some families of players who died from long-term effects of head trauma caused through playing football. As noted on Health Central's Site, there have been studies that have found that Alzheimer's Disease, CTE, dementia and other similar brain diseases appear to have been diagnosed at a much higher level in retired pro football players than in the U.S. population.

Free Resources:

Online Concussion Management Training

Per ORC 3707.52 as enacted by Ohio HB 143 of the 129th General Assembly, ODH is required to post free training programs that train coaches and referees in recognizing the signs and symptoms of concussions and head injuries.

The following free online trainings have been approved by the Ohio Department of Health for coaches and referees:

National Federation of State High School Associations Concussion in Sports - What you Need to Know: http://www.nfhslearn.com/electiveDetail.aspx?courseID=38000
(This free on-line course is available through the NFHS. You will need to click the "order here" button and complete a brief registration form to take the course.) Follow these steps to complete the course:

1. Click on the button that says, please login to order. In the window that appears, click Register Now.
2. When your registration is complete you may "order" the free concussion course offered along the left hand side of the page. Continue following prompts. Although it may look like you'll be charged for the course, there is no cost.
3. Once you've completed "checkout," you'll be able to take the free online course.
4. When you've completed and passed the course, you have the option of printing a certificate of completion.

Centers for Disease Control and Prevention Heads Up Concussion in Youth Sports On-Line Training Program: http://www.cdc.gov/concussion/HeadsUp/online_training.html

PLEASE NOTE: Both courses offer a “certificate of completion” upon successful passage. The NFHS course allows organizations to search for and track coaches who have completed the course while the CDC course does not.

The Mayo Clinic has also made baseline testing available to anyone, free of charge. The Clinic's cognitive test gives a healthcare provider an "objective snapshot" of an athlete's "Before" brain function. You can go onto the site, take the test, save it in a password-protected format and print it out. If you sustain a concussion you can also take a post-injury test and take them both to your doctor. The testing site location is: http://www.mayoclinic.org/concussion-testing/

Cleveland Clinic Diagnostic Tools: A medical professional should provide a neurological check, along with a mental status evaluation that includes orientation, concentration, balance and amnesia. No athlete with symptoms at rest or with activity is permitted to return to play.

While many athletes experience only temporary neurological impairment lasting one to two days, some athletes have symptoms lasting weeks to months. That is why it’s important for athletes to undergo a more thorough evaluation by a physician, experienced in evaluating and treating concussions, before starting a progressive return to play.

http://my.clevelandclinic.org/concussion-center/default.aspx

http://my.clevelandclinic.org/concussion-center/diagnostics-testing.aspx