

Sports Concussion

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CHAPTER

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Although head injuries are common in all contact sports, the vast majority are minor. Sports in which minor head injuries are seen include football, boxing, gymnastics, horse riding and martial arts.

Major head injuries are a medical emergency. The sports medicine practitioner's role in the management of acute head injuries is to recognize the problem, ensure immediate resuscitation and transfer the injured athlete to the appropriate facility. The immediate management of severe head injuries is considered in Chapter 44.

Definition

Concussion is the term commonly used to describe a type of minor head injury. The recent expert consensus conferences on sports concussion held in Vienna (2001) and Prague (2004) redefined sports concussion as follows: concussion is 'a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces'. Several common features that incorporate clinical, pathological, and biomechanical injury constructs that may be used in defining the nature of a concussive head injury include:

1. Concussion may be caused by 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.
3. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury.

4. Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course.
5. Concussion is typically associated with grossly normal structural neuroimaging studies.^{1,2}

Many publications on concussion also refer to the Glasgow Coma Scale. The Glasgow Coma Scale has stood the test of time in distinguishing between mild, moderate and severe head injury and for the measurement of serial change in clinical status post-injury. The Scale, however, does not encompass sport concussion due to the mild nature of the symptoms involved. The terms 'mild brain injury' (MBI) and 'concussion' are not synonymous. Concussion is a subset of MBI but the converse is not true.

The recent Prague consensus conference^{1,2} also separated different subtypes of concussion based on symptom duration. While this separation remains to be validated scientifically, it nevertheless reflects the common clinical management situation and may have implications in future management and/or resource utilization. The two categories are as follows:

1. *Simple concussion*: the injury progressively resolves without complication over seven to 10 days.
2. *Complex concussion*: the athlete suffers persistent (>10 days) symptoms either at rest or with exertion.

Concussion is common in all contact sports. The incidence ranges from 0.25–5 per 1000 player hours of exposure. Professional horse jumping jockeys have

the highest concussion rate of any sport, followed by Australian footballers.

Applied pathophysiology

Although neurological dysfunction in concussion is transient, the athlete has sustained significant impact to the brain. More severe forms of diffuse brain injury involve shearing forces to the brain, which cause pathological damage. In concussion, it remains controversial as to whether any pathological damage occurs. Most, if not all, of the neurological symptoms reflect a functional rather than structural injury to neurons.

The concussed athlete, although conscious and without obvious focal neurological signs, may have impaired higher cortical function, for example, impaired short-term memory. These subtle cognitive changes may only be detected by neuropsychological testing.

Following a blow to the head, the athlete's conscious state may be altered. This may vary from simply being stunned to a significant loss of consciousness. Memory is typically affected in a concussive episode. A period of retrograde amnesia, that is, loss of memory of events prior to the incident, or post-traumatic amnesia, that is, loss of memory of events after the incident, may follow minor head injury. The duration of retrograde or post-traumatic amnesia does not indicate the severity of the concussive episode.

The ability to think clearly, concentrate on tasks and process information will also be affected. Concussive symptoms such as headache, dizziness, blurred vision and nausea may also be present.

Frequently, in episodes of mild concussion ('bell ringers'), the athlete will be dazed or stunned for a period of seconds only and continue playing. The other players and coaches may be unaware that a concussive episode has occurred. Alert medical and training staff should closely observe the actions of a player who has received a knock to the head for any signs of impaired performance.

Grading of concussion

There is no reliable or scientifically validated system of grading the severity of sports-related concussion. At the present time, there are at least 28 published anecdotal severity scales. The danger is that athletes and/or their coaches may 'shop around' for a scale that is not in their best medical interests. At the end of the day, good clinical judgment should prevail over written guidelines.

At the first international conference on concussion in sport (Vienna, 2001)³ the expert committee endorsed no specific grading system for concussion but recommended that combined measures of recovery should be used to assess injury severity and guide individual decisions on return to play. This was re-endorsed at the Prague 2004 meeting.^{1,2} Sideline evaluation such as using the SCAT (Standardized Concussion Assessment Tool) card^{1,2} or similar tool is recommended.

Complications of concussion

Impaired reaction time and delayed information processing associated with concussion may result in the athlete failing to cope with potentially injurious situations and sustaining further cerebral or musculoskeletal injury.

In the acute situation, concussive convulsions or tonic posturing may be observed immediately after impact. These benign but dramatic phenomena are a non-epileptic manifestation of concussion.⁴

If a player recommences playing while symptomatic, post-concussive symptoms may be prolonged. This may also increase the chance of developing the 'post-concussive syndrome', in which fatigue, difficulty in concentration and headaches persist for some time, often months, following the original injury. This syndrome is uncommon in sport.

The so-called second impact syndrome is said to result in catastrophic brain swelling in response to repeated concussive injury. A recent review has cast doubt as to the existence of this syndrome.⁵

Multiple concussive episodes may result in chronic cortical dysfunction. This is most evident in boxers who suffer repetitive head injuries, often over a lengthy period, resulting in gross pathological and neuropsychological changes. This is referred to as the 'punch-drunken syndrome'.

Management of the concussed athlete

Exclude serious injury

The most important task for the clinician confronted with a concussed athlete is to exclude the presence of serious head injury or spinal injury. If the athlete is unconscious, the clinician should assume the presence of a head injury and spinal injury and manage the patient accordingly (Chapter 44).

If the patient is conscious, the first step is to exclude the presence of a spinal injury. Once this is done, the