

Concussion — Recognition, Treatment, and Complications

RECOGNITION

Head injuries are prevalent in contact sports and are especially common in boxing, kickboxing, and mixed martial arts. A wide spectrum of head injuries can occur from a mild concussion to a catastrophic cerebral hemorrhage (bleeding inside the brain.) Competitors, as well as those who care for them, must be aware of the acute symptoms that may present following these injuries in order to avoid further damage. In addition, proper recognition and treatment of head injury can prevent potentially devastating, long-term complications.

An exhaustive discussion of all types of closed head injury is beyond the scope of this article; however, unarmed combatants, trainers, and managers should be aware of the spectrum of injuries. Serious head injuries include epidural hematomas, subdural hematomas, subarachnoid hemorrhages, and diffuse axonal (brain cell) injuries. These injuries all require immediate, advanced medical treatment in a hospital setting. Fortunately, these serious injuries are uncommon occurrences. Concussion is a much more common head injury.

The term “**concussion**” is commonly used to describe a person who experiences a knock-out blow. However, a competitor may suffer a concussion without actually being knocked out. Concussions are events of **traumatic brain injury (TBI)**. The American Academy of Neurology defines a concussion as a “trauma-induced alteration in mental status that may or may not involve loss of consciousness.” (1) Furthermore, concussion involves a change in brain function caused by a direct or indirect force transmitted to the head.

Concussion results in one or more of the following symptoms: light headedness, vertigo (sensation of spinning that causes loss of balance), a brief loss of consciousness, loss of memory, cognitive dysfunction, blurred vision, tinnitus (ringing in the ears), difficulty concentrating, headache, vomiting, nausea, photophobia (sensitivity to light), or dizziness. (see **Table 1**) A fighter may receive a blow to the head, face, neck, or body causing forces to be transmitted to the head without an awareness of a blackout. The event may be quite rapid with a short-lived loss of neurologic function that resolves spontaneously. Alternatively, a concussion may be more obvious with a longer recovery period. (1,3,4)

Table 1: Acute Signs and Symptoms of Concussions

Cognitive	Physical	Emotional
Confusion	Headache	Emotionality out of proportion to circumstances
Loss of consciousness (LOC)	Migraine	
Disorientation	Fatigue	Irritability
Inability to remember what happened before head injury (retrograde amnesia)	Dizziness	
Inability to remember what happened after head injury (antegrade amnesia)	Loss of balance	
Vacant stare or befuddled facial expression	Nausea/vomiting	
Failure to focus/ follow simple commands	Blurry vision	
Memory deficits	Double vision	
Delayed verbal responses	Sensitivity to light	
Obvious incoordination (inability to walk in a straight line)	Sensitivity to sound	
Slurred/incoherent speech		
Excessive drowsiness		

Signs and Symptoms referenced from 1, 2, 3, 5, and 6

Brain injury can occur without evidence of external trauma (laceration or bleeding) to the head. The mechanism of injury usually entails a violent contact force and/or acceleration/deceleration movements of the head. As the brain sits inside of the skull, rapid changes in head position occur creating the potential for injury. Doctors refer to this type of injury as **coup** and **contrecoup**, as the brain has been rattled against the skull causing contusions. The cortical contusions (**brain bruises**) are associated with localized loss of blood flow to the surrounding brain tissue and with swelling of the brain tissue.

Coup is defined as the brain injury occurring on the same location where the force impacts. **Contrecoup** is defined as the brain injury occurring on the opposite side of the brain where the force impacts the head. (See Figure 1)

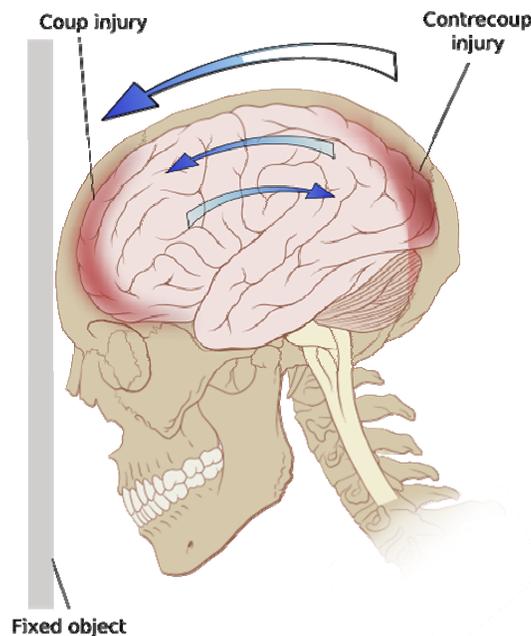


Figure 1

BASIC TREATMENT

If an unarmed combatant is suspected of having a concussion, a very basic neurological evaluation should be performed. If a medical professional is not immediately available, the examination can be performed by a trainer or another fighter. Assess the injured athlete's level of consciousness, concentration, speech, memory, vision, and coordination. A simple outline of an exam is presented in Table 2.

Table 2: Simple Neurological Exam

Orientation	Have athlete name city, opponent, day, month, and year
Concentration (Immediate)	Have athlete repeat five words in correct order
Retrograde Amnesia	Have athlete recall events prior to the injury to check for retrograde amnesia
Memory (recall)	Have athlete repeat the same five words in correct order after a 5 minute delay
Vision	Have athlete count your fingers and look into athlete's eyes to see if the pupils are the same size
Coordination	Have athlete stand on one foot to assess balance

If the athlete has lost consciousness, he should be transported to a hospital immediately. If the athlete is unable to perform the simple exam outlined above, he should be transported to the hospital. If an unarmed combatant has any symptoms related to a concussion, the athlete should not continue with the current training session or match. The athlete should be evaluated by a physician before returning to competition. Most importantly, an unarmed combatant who experiences symptoms following a concussion requires serial neurologic evaluations for as long as the symptoms persist to determine if the athlete's condition is deteriorating.

Observation of the athlete may be permitted at home if the physician determines the neurologic condition is very unlikely to deteriorate. Another person (an observer) should be in close contact to the fighter for the first 24 hours. The observer needs to be given explicit instructions on monitoring the following:

- inability to awaken the athlete

- severe or worsening headaches
- somnolence or confusion
- seizures
- visual disturbances
- vomiting
- urinary or bowel incontinence
- weakness or numbness of any body region

The athlete should be awakened every two hours for the first night and stay away from all strenuous activity for 24 hours. If any of the above signs are present, this may indicate increased brain swelling or hemorrhage caused by brain contusions (bruises). This is an indication to seek **immediate** additional medical care at a local hospital. (1) Furthermore, an athlete will be held from competition and activity for a **minimum of one week**. Return to competition will be determined by the physician based on the fighter's traumatic brain injury (TBI) history and absence of symptoms.

COMPLICATIONS

As with any injury, there is a risk for long-term complications. The risk is increased by the number of traumatic events that occur within a short time duration. If a fighter experiences only one concussion, the potential for long term effects is minimal. However, multiple concussions can lead to complications such as Postconcussion Syndrome, Second Impact Syndrome, and Post-Traumatic Seizures. **Postconcussion syndrome** consists of headache, dizziness, difficulty with concentration, sleeplessness, and loss of energy. These symptoms typically present in the first days after a mild TBI. (1,6) Another complication competitor's must recognize is **Second Impact syndrome**. If the athlete is still symptomatic, the brain has not fully recovered from the first traumatic event. The brain cells are highly vulnerable to a second traumatic event. Potential diffuse brain swelling can result after a second concussion. The second blow could be very minor, not directly contacting the head such as a blow to the chest; however, the sudden changes in head position with the acceleration/deceleration movements are strong enough to create brain swelling to the already weakened tissue. This complication would require urgent treatment and may even result in death. (8,9) The athlete should seek the care of a physician if any of these problems arise.

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