

Concussion prevention starts in the gym

Abstract

Concussions are common in combat sports such as boxing and mixed martial arts (MMA). In these sports every punch thrown to the opponent's head is thrown with the intention of winning by causing a knockout (KO) which is nothing but a concussive head injury. Other acute traumatic brain injuries such as traumatic subdural hematoma (SDH), epidural hematoma (EDH), intracranial hematoma (ICH), subarachnoid hemorrhage (SAH) remain an omnipresent danger. Traumatic SDH is the most common boxing related mortality reported in medical literature. These combatants either collapse in the ring/cage or soon thereafter. Many perish due to the TBI. Others may survive due to a timely decompressive craniectomy but are left behind with severe and persistent neurological deficits. Analysis of some of these combat sports related mortalities suggest that the combatant may have suffered a concussion while sparring in training camp. A concussed boxer entering the ring is vulnerable to another concussive injury and second impact syndrome. It is thus imperative that concussions in training camps and gyms be recognized and attended to in a timely fashion.

Keywords: concussions, combat sports, boxing, mixed martial arts

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Commentary

A concussion is described as a transient dysfunction of the brain caused by head impact exposure (HIE).¹ In the past concussion was thought to represent a functional neurological injury with no long-term structural damage. Now we know this is not the case. A concussion is associated with biochemical and structural changes in the brain.

Common symptoms of a concussive brain injury include headache, feeling off balance, light and sound sensitivity (photophobia, phonophobia), nausea, vomiting, problems with gait and balance.² Here it is important to remember that many if not all symptoms are subjective. If the combatant or his corner is not educated about concussion, they will fail to recognize it. Objective signs such as gait disturbance and pupillary asymmetry usually indicate a more severe grade of head injury. Any combatant displaying these signs whether in a gym or in a professional setting (during a professional bout) needs rapid triage and transfer to the nearest Level I trauma center for evaluation and management of TBI. Apart from HIE, dehydration, sparring without head gear or custom fitted mouthpiece predisposes the athlete to a concussion. The severity of HIE can vary in boxing. Concussive properties of a boxer's punch is related to the manner in which the punch is delivered, how the mechanical forces are transferred and absorbed through the intracranial cavity. Blows thrown from the shoulder, such as the roundhouse or hook, tend to deliver more force than the straight forward jab leading to at times rapid loss of body tone and consciousness. The force transmitted by a punch is directly proportional to the mass of the glove and the velocity of the swing, and is inversely proportional to the total mass opposing the punch. It is important to remember that the essential feature of a concussive force is that the force is sufficient enough to accelerate the skull. Rotational (angular) acceleration, linear (translational) acceleration, and impact deceleration can all play a role in the development of acute cerebral injury. Angular acceleration occurs when a punch causes a rotational movement of the skull that can potentially stretch and tear cerebral blood vessels. Linear acceleration occurs from blows directly to the face in an anterior to posterior direction, which may

result in gliding contusions. Rotational acceleration more commonly induces a concussion and often causes diffuse brain injury (diffuse axonal injury). Force produced by a blow is usually some variable combination of linear and rotational acceleration. Once a boxer is knocked down and strikes the cranium on the floor mat, a rapid deceleration (impact deceleration) occurs that can result in contrecoup contusions.

Concussions during training (fight) camp

Leading up to a professional fight, a boxer sets up a training camp (popularly referred to as fight camp). Fight camps are traditionally 6-8 weeks training camps leading up to the professional fight. Some are shorter or longer in duration depending upon the notice the fighter gets in advance. The camp serves several purposes including but not limited to weight cutting with a goal to reach the weight that was agreed upon in the fight contract, strength training and conditioning and sparring. A typical day in the fight camp may involve an early morning run followed by shadowboxing, padwork and heavy bag work. Strength and conditioning exercise might follow under the direction of the strength and conditioning coach. Sparring does not take place every day. Sparring partners usually are carefully chosen with the intention of creating a challenging but safe environment for the boxer to hone and improve his skills. Their boxing style usually resembles that of the boxer's proposed opponent. The intensity level of the sparring is usually dictated by the coach. The goal is not full force sparring to cause a knockout or risk an injury, rather the focus is to challenge the boxer and help develop the technique, movement (footwork) and boxing skillset. Boxers may or may not wear headgear during sparring sessions. Experienced coaches hence instruct the sparring partner not to hand hard shots. Despite this, concussive head injuries may occur during sparring. These may or may not be recognized in camp. If they are missed, one risks a concussed boxer entering the ring or cage to compete. Such a boxer is a high-risk boxer one who is susceptible to suffering an acute TBI (such as SDH) or second impact syndrome.³

Concussions in gym

Boxing, MMA and kick boxing are popular classes that people take in gyms to improve their fitness and cardiovascular health. During some of these classes sparring sessions are held. While headgear is worn, many of these classes are unsupervised. As a result, HIEs and concussions can occur. Again, since the symptoms of concussions are predominantly subjective, many participants are unaware that they have suffered a concussion and may continue to train and spar. Ignoring a concussive head injury, increases the likelihood of risking a more severe form of head injury and persistence of post-concussion syndrome (persistent post-concussive syndrome).⁴

How to address concussions in training (fight) camp

Training camps are usually closed off to the public. There is frequently no medical supervision of these camps. The combatant and his coach likely shall not voluntarily report a concussion to the State Athletic Commission (under whose jurisdiction the fight is scheduled to take place) for fear of reprisal and medical disqualification. This combatant may potentially clear the weigh-in and pre-fight medical examination and enter the ring still symptomatic. In the ring or cage this concussed athlete is vulnerable to further HIEs, concussions, acute TBI and second impact syndrome.

The following are advised to address concussions in training camp:

1. Training (fight) camps should be conducted under the supervision of a physician.
2. Education is the key. Combatant, sparring partner(s), coaches and trainers should be educated on how to recognize and manage concussions.
3. The common signs of a concussion are:
 - a. Headache
 - b. Dizziness
 - c. Subjective feeling of balance
 - d. light and sound sensitivity
 - e. Irritability
 - f. Inability to concentrate or multi-task
 - g. Gait instability
4. If a combatant suffers a concussion while training, he should be advised to stop sparring and be evaluated by a physician. The combatant should be advised to have a few days of cognitive and physical rest till acute symptoms resolve and then begin a graded and gradual return to training program.
5. The combatant should be cleared by a medical professional before returning to active sparring.
6. The concussion must be reported to the concerned State Athletic Commission under whose jurisdiction the combatant is scheduled to fight.
7. Reporting the concussion should not risk automatic cancelation of the fight by the State Athletic Commission. This would be viewed as punitive action. Instead, the State Athletic Commission should closely evaluate the boxer at the time of the weigh-in and pre-fight physical and determine his/her neurological fitness to proceed.

How to address concussions in the gym

Boxing and MMA are excellent forms of exercise. Due to their popularity, boxing and MMA classes are now offered in most gyms. There is no medical supervision of these classes including sparring sessions. Head impact exposures and concussions are hence common.

The following are advised to address concussions in gyms:

1. Education remains the key. Participants, boxing coaches and trainers should be educated on concussion recognition and management.
2. The common signs of a concussion are:
 - c. Headache
 - d. Dizziness
 - e. Subjective feeling of balance
 - f. light and sound sensitivity
 - g. Irritability
 - h. Inability to concentrate or multi-task
 - i. Gait instability
3. Concussion signs should be prominently displayed in every boxing/MMA gym.
4. If a participant suffers a concussion or hard HIE, he/she should be advised to stop training/ participating in class and be evaluated by a physician.
5. The participant should be advised a few days of cognitive and physical rest till acute symptoms resolve.
6. A graded and gradual return to play (RTP) should commence only after medical clearance from the physician.
7. When in doubt, sit it out should be the mantra.

Conclusion

Concussions are common in boxing and other combat sports. Education remains the cornerstone to prevent concussions, ensure timely identification and management of these head injuries. All concerned stakeholders which include athletes, coaches, trainers, sport's governing bodies and athletic commissions should work together to draft policies and protocols designed to make the sport safer. Concussion prevention needs to start in the gym and in training (fight) camps.

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Conflicts of interest

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