Opinion

Concussion injury in combat sports: 20 clinical care and take-home points for referees and ringside physicians

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Introduction

Professional boxing is a popular combat sport worldwide. It is also unique in that every punch thrown to the opponent's head is thrown with the intention of winning by causing a knockout (KO). Due to the nature of the sport, head impact exposures (HIEs) are common. As a result, boxing carries a high risk of concussions and more severe forms of acute traumatic brain injury TBI). Professional boxing and mixed martial arts (MMA) is regulated by state athletic commissions in the United States and around the world. In most jurisdictions the referee is the sole arbitrator of the bout. In some Commissions such as the New York State Athletic Commission, either the referee or the ringside physician can stop a bout. Thus, it is imperative that both referee and ringside physician be aware of the clinical presentation and management of concussion and more severe forms of TBI. In this commentary 20 clinical care points are elucidated which every referee and ringside physician should be aware of.

Twenty clinical care points which referees and ringside physicians should be aware of:

1) Concussion is defined as a transient alteration of mental status due to biomechanical forces affecting the brain.
2) Concussive injuries are common in combat sports such as boxing and mixed martial arts (MMA) since head impact exposures (HIEs) are common.
3) In these sports every punch thrown to the opponent's head is thrown with the idea of winning by causing a HIE leading to a knockout (KO). So, sports such as boxing and MMA are associated not only with a high risk of concussions and also more severe forms of acute TBI.
4) Knockout, a fight-ending winning criterion in combat sports such as boxing and MMA is considered any legal strike or combination thereof that renders the opponent unable to continue fighting.[1] Concussive injury is common when a KO is the result of a HIE.
5) In a KO due to a HIE, the injured combatant falls to the canvas and is unable to continue fighting due to sudden loss of consciousness (LOC) or disorientation. While LOC is easy to identify, brief lapse in awareness or disorientation may be missed by referee and ringside physician.
6) A KO is an automatic win for the opponent. The fight is stopped, and ringside physicians should immediately enter the ring or cage to render care to the downed fighter.
7) The duration of LOC can vary after a KO. It may vary from a transient LOC or awareness to more prolonged LOC.
8) Concussive properties of a boxer's punch are related to the manner in which the punch is delivered, how the mechanical forces are transferred and absorbed through the opponent's intracranial cavity. The force transmitted by a punch is directly proportional to the mass of the glove, the velocity of the swing, and inversely proportional to the total mass opposing the punch (opponent's head). Blows thrown from the shoulder, such as the roundhouse or hook, tend to deliver more force than the straight forward jab and are more likely to cause a KO.
9) A knockdown happens when a boxer falls to the ground because of a blow from the opponent. The boxer must have at least one part of his body other than his feet touch the canvas for it to be considered a knockdown.[2] Concussive injury is common when a knockdown is the result of a HIE.
10) Knockdown due to a HIE causes the boxer to experience LOC or alteration in the level of awareness. The referee may stop the bout at once or count to 10. The injured boxer must regain position and demonstrate to the referee his/her fitness to fight for the bout to continue.
11) If the injured boxer is unable to demonstrate to the referee his/her fitness to fight after a HIE despite still standing, a technical knockout (TKO) due to head shot/s is ruled. The fight is stopped and ringside physicians should immediately enter the ring to assess the fighter.
12) In combat sports, fighters may experience transient loss of awareness/disorientation/unsteadiness after a HIE but still be able to demonstrate to the referee/ringside physician their "fitness" to fight. These fighters should be closely watched, and the fight stopped on medical grounds if any signs/symptoms of concussive injury are noted.
13) It is important for referee and ringside physicians to remember that clinical presentation of concussive head injury in the ring or cage can be remarkably varied.

Examples include:

a) a boxer "out on the feet"-unable to defend himself, looks dazed, may stagger around the ring (exhibit gross motor incoordination) or rest on the rope.

b) boxer is knocked down and cannot rise before the count of ten but does not experience loss of consciousness. On neurological assessment this boxer is usually confused, disoriented, and exhibits retrograde/anterograde amnesia.

c) boxer is rendered unconscious but recovers quickly (period of LOC is very brief). On neurological assessment this boxer is usually confused, disoriented, exhibits retrograde/anterograde amnesia and is unable to maintain stance/balance.

d) boxer is rendered unconscious. The period of unconsciousness and retrograde/anterograde amnesia is longer.

14) It is important for referee and ringside physicians to remember that any combatant who experiences any duration of LOC after a HIE whether because of a KO or a knockdown has suffered a concussive head injury.

15) Acute subdural hematoma (a type of severe TBI) is the most common cause of boxing related mortality.

16) Concern for acute TBI is raised in a combatant who experiences prolonged or persistent:

a) Loss of consciousness

b) Retrograde/anterograde amnesia

c) Vomiting

d) Complaint of headache

e) Unsteadiness

f) Inability to maintain stance and balance

17) Concern for acute TBI is raised in a combatant displaying neurological signs such as:

a) Depressed sensorium

b) Disorientation to person, place, and time

c) Glasgow coma scale (GCS) less than 13

d) Unequal pupils (one pupil is dilated and does not react to light)

e) Weakness on one side

f) Incoordination

g) Ataxia

18) A fighter who has suffered a concussive injury should be carefully evaluated by ringside physicians in the locker room. A stable fighter (asymptomatic with a normal neurological examination) can be discharged from the venue with advice to the coach/family to observe closely for the next 24 hours, to call 911 and go to the nearest hospital if the boxer complains of neurological symptoms such as headache, exhibits change/depression of sensorium or starts to vomit. Prior to discharge, the athlete is administered a period of medical suspension (usually 90 days) and advised a period of cognitive and physical rest.

19) It is important for ringside physicians to remember that when it comes to acute TBI management and prognosis, time=brain.

20) For a fighter in whom concern for acute TBI is raised, the event medical team (ringside physicians, EMS personnel) should facilitate immediate transport via onsite ambulance and as per established Advanced Trauma Life Support (ATLS) guidelines to the nearest Level I trauma center for thorough assessment with neuroimaging and definitive management by neurology and neurosurgery physicians.

Conclusion

Concussive injury is common in combat sports such as boxing and MMA. Early identification and proper management of concussive injury ensures good outcome in most fighters, helps maintain brain health and prevent long-term neurological disability. Combat sports also carry the risk of more severe acute TBI. By stopping a bout in time, referees and ringside physicians protect the health of the fighters.

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