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Review Article

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Individualizing medical suspension after knockout in boxing-no two knockouts are the same

Background

Professional boxing carries high risk of acute traumatic brain injuries (TBIs). Subdural hematoma is the most common neurological cause of boxing related mortality. Other acute TBIs in boxing include epidural hematoma, intracranial hematoma, cerebral contusions, dissection of large vessels of the neck and concussion. Concussion or mild TBI is common in a sport like boxing where every punch thrown at the head is thrown with the idea of winning by causing a knockout (KO) which is nothing but a concussive injury of the brain. After a KO, the boxer is typically given a medical suspension. The adequate duration of medical suspension after a KO has neither been determined nor standardized.

Discussion: The duration of medical suspension after KO in boxing should be determined based on the severity of the head impact exposure (s) sustained by the boxer. Concussive properties of the punch such as the force, velocity and way punch was delivered, age of the boxer, fight record of the boxer and history of prior concussions should be factored in when determining the optimal duration of medical suspension.

Conclusion: The optimal duration of medical suspension after a KO injury is currently not standardized and varies from Commission to Commission. It is important for ringside physicians to remember that no two concussive injuries are the same. Individualizing duration of medical suspension after KO shall help to enhance the health and safety of the boxer.

Keywords: boxing, concussion, knockout, medical suspension

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Introduction

Professional boxing, a popular combat sport carries high risk of TBIs. In professional boxing fighters do not wear protective head gear and every punch thrown at the head is thrown with the sole intention of winning by causing a KO which is nothing but a concussive brain injury. In combat sports, a KO is considered any legal strike or combination thereof that renders the combatant unable to continue fighting. In boxing, a KO occurs when the referee can administer a ten count to a fallen or impaired fighter who is unable get back to his or her feet within the time limit. This usually occurs when the boxer is struck with a punch to the head leading to immediate but usually transient loss of consciousness. The boxer falls to the canvas and is unable to get up and continue. A KO needs to be differentiated from a technical knockout (TKO) which occurs when either the referee or the ringside physician decides to stop the fight to protect the boxer from further physical trauma. After a KO, the boxer usually receives immediate medical attention in the ring. Most boxers after a KO exhibit transient loss of consciousness with varying duration of anterograde and retrograde amnesia. Neurological examination post fight usually reveals a non-focal examination with Glasgow Coma Scale (GCS) between 13-15. If the ringside physician determines that the KO boxer is clinically stable, he or she is given a medical suspension and discharged from the venue. The duration of medical suspension is arbitrary ranging from 30 to 180 days.

The following medical decision-making process with respect to duration of medical suspension after KO in boxing is proposed based on personal ringside experience and review of existing medical literature.

a) Boxers who do not experience loss of consciousness after a KO should be medically suspended for duration of 30-45 days.

b) Boxers, who experience brief loss of consciousness after a KO, are asymptomatic, neurologically intact with GCS score of 15 and no significant post-traumatic amnesia should be medically suspended for duration of 90 days. A neurology clearance from an independent neurologist should be requested prior to return to professional boxing.

c) Boxers who experience any loss of consciousness after a KO, voice post-concussion symptoms (headache, dizziness, nausea, light sensitivity, sound sensitivity, impaired attention, impaired concentration), are neurologically intact with GCS score of 13-15 and significant post-traumatic amnesia should be suspended indefinitely and transported to the nearest Level I trauma center via onsite ambulance for urgent neuroimaging (either computed tomography head or magnetic resonance imaging of brain). The final duration of medical suspension should be determined based on results of neuroimaging study and specialist evaluation.

Discussion

At present we lack a standardized definition of concussion and mild TBI (mTBI).[1] in the absence of validated biofluid (blood/CSF) and imaging biomarkers separating concussion as a distinct pathophysiological entity from mTBI is difficult and at times the terms are used interchangeably.[2] Currently mTBI is defined as a traumatically induced physiological disruption of brain function manifested by at least one of the following: any period of loss of consciousness, any retrograde or anterograde amnesia, any alteration in the level of consciousness and focal neurological deficit(s) that may or may not be transient. Patients are classified as suffering mTBI when loss of consciousness is approximately 30 minutes or less, an initial Glasgow Coma Scale (GCS) of 13–15 and posttraumatic amnesia (PTA) does not exceed 24 hours.[3] While historically concussion was used to describe patients briefly disabled following a head injury, with the assumption that this was a transient disorder of brain function without long-term sequelae, it is now been recognized the symptoms are highly variable in duration, may persist for many years with the

potential to cause adverse cognitive, neurobehavioral and functional outcomes.[4]

No two concussive injuries or KOs are the same. Concussions in boxing can be graded as:

Grade 1 (mild concussion): "Boxer is out on the feet"-unable to defend himself, looks dazed, may stagger around the ring or rests on the rope.

Grade 2 (mild concussion): boxer is knocked down and cannot rise before the count of ten but does not experience loss of consciousness.

Grade 3 (moderate concussion): boxer is rendered unconscious but recovers quickly.

Grade 4 (severe concussion): like grade 3, except the period of unconsciousness and retrograde/anterograde amnesia longer.

The above grading though is not scientific and largely based on medical expertise and clinical experience of ringside physicians. It also does not consider the biomechanical properties of the concussive punch. Based on physical mechanism of injury, TBIs are classified as occurring due to either contact or "impact" loading when the head is struck against an object and noncontact or "inertial" loading when the brain moves within the cranium. Impact loading usually causes focal injuries such as hemorrhagic brain contusions while diffuse axonal injury is usually on account of inertial loading. Concussive properties of a boxer's punch are related to the way the punch is delivered and the way mechanical forces are transferred and absorbed through the opposing 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 (head) opposing the punch. Blows thrown from shoulder, such as the roundhouse or hook generate angular acceleration and tend to deliver more force than the straight-forward jab which generates linear 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 countercoup contusions. Thus, varying grade of rotational (angular) acceleration, linear (translational) acceleration, and impact deceleration all play a role in the development of acute TBI in boxing.

Rather than a one size fits all model, an attempt should be made to individualize the duration of medication suspension after a KO injury in boxing. Ringside physicians should remember that no two concussive injuries are the same and no two KOs are the same. The duration of medical suspension should be determined after factoring in concussive properties of the punch such as the force, velocity and way punch was delivered, duration of loss of consciousness, duration of post-traumatic amnesia, GCS score after head impact exposure, age of the boxer, fight record of the boxer and history of prior concussions.

Conclusion

The optimal duration of medical suspension after a KO injury should be debated vigorously by the ringside physician community and be further refined by conducting well designed longitudinal studies on boxers. Evidence based medical recommendations should then follow. Individualizing duration of medical suspension after KO shall help to enhance the health and safety of the boxer.

Acknowledgments

None.

Conflicts of interest

Authors declare that there is no conflict of interest.

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