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Commentary

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Preventing boxing related mortality- in no sport should an athlete die

Abstract

While concussive head injuries are exceedingly common in boxing, mortality in boxing is usually on account of traumatic SDH. Many young boxers have perished in the ring leading to calls by physicians and physician associations to ban the sport of boxing. Can the incidence of traumatic SDH be reduced by enhanced medical protocols and implementation of a range of rules and regulations aimed at minimizing risk and ensuring the health and safety of combatants?

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Introduction

Professional boxing, a popular combat sport, carries high risk of acute traumatic brain injuries (TBIs). It is a unique sport in the sense that every punch thrown at the opponent's head is thrown with the intention of winning by causing a knockout (KO). A knockout is characterized by a sudden loss of body tone; the boxer falls to the canvas and suffers loss of consciousness (LOC). The duration of LOC can vary from a few seconds (the downed boxer immediately tries to get up and demonstrate to the referee his fitness to continue to fight) to a more prolonged LOC lasting few minutes. If the boxer is unable to continue, the fight is stopped by the referee or ringside physician. While concussive injuries as described above are exceedingly common in boxing, more severe TBIs also occur. Traumatic subdural hematoma (SDH) remains the most common cause of boxing-related mortality. Young boxers continue to perish in the ring due to this devastating injury. In no sport should an athlete die. This commentary explores whether this boxing related cause of mortality is preventable.

Commentary

Presentation

Traumatic SDH remains the most common cause of boxing-related mortality.1–4 In a sport where every punch thrown at the opponent's head is thrown with the intention of winning by a KO, the reason why this devastating head injury is common in boxing is not difficult to fathom. The clinical presentation of traumatic SDH can vary in boxing. It is said in boxing "a single punch can kill". Traumatic SDH can thus have a rather abrupt dramatic presentation where amid the fight after sustaining a punch to the head, the boxer collapses and never regains consciousness. The injury can also present more insidiously where-in the "impaired" boxer continues to fight sustaining more head shots and collapsing either in the later rounds or after the fight is over. This walking, talking and dying presentation can manifest clinically while the boxer is still in the arena or even later in the hotel when the boxer has retired for the night.

Why young boxers perish from traumatic SDH

It is important to realize why young boxers are so susceptible to dying or sustaining an adverse outcome from a traumatic SDH. The Monro-Kellie doctrine states that the rigid skull has a fixed volume, and the total volume of brain tissue, intracranial blood and cerebrospinal fluid must remain constant. If there is a sudden increase in the volume of one of these components (in our case intracranial blood), it leads to a sudden rapid increase in intracranial pressure (ICP). Cerebral perfusion pressure (CPP) equals mean arterial pressure minus ICP. As the ICP rises rapidly in the young boxer, it leads to a rapid loss of CPP. If this boxer is not rushed to the hospital in a timely fashion, brain death is inevitable. If the boxer reaches the hospital alive, decompressive craniectomy surgery is performed in an emergent fashion. This neurosurgical procedure involves removing a part of the skull bone allowing the herniating brain room to expand. At times despite this surgery, malignant rise in ICP leads to brain death. Occasionally a timely and "generous" decompressive craniectomy (a large portion of the skull plate is removed to relieve ICP) may save the life of the boxer. While lifesaving, the boxer is usually left with significant neurological deficits and at times a fate worse than death itself. Many physician associations over the years have thus called for a ban on boxing.5,6

How to protect boxers from traumatic SDH?

Education: In no sport should an athlete die. Combat sports too should be no different and held to the same standards as more mainstream sports such as tennis and soccer. Recently the boxing world learnt the sad news that 2 Japanese boxers fighting on the same card had succumbed to death from traumatic SDH.7 Since boxing is a striking sport with the main aim of winning by causing concussive head injury, it cannot be made 100% safe. Unfortunately, boxers will continue to perish in the ring from traumatic SDH. That is the sobering reality that everyone involved in the sport should be aware of. Especially professional boxers for whom the sport is more than a sport, it is a way of life, it is their livelihood. Many boxers come from underprivileged backgrounds and perceive boxing as a vehicle for upward social mobility and financial advancement. Many lack formal education and are blissfully unaware of the risks of acute and chronic neurological injuries associated with boxing. Educating boxers of these risks shall go a long way, helping to make the sport safer. It shall help them make educated choices on all aspects of the sport such as adopting safe practices while sparring, realizing they are concussed and saying, "no mas" and when to retire and hang up their gloves for good. "No mas" a Spanish phrase meaning "no more" gained notoriety when in the fight between Sugar Ray Leonard and Roberto Duran, Duran quit the fight after uttering it. The boxing culture must change. Boxers need to realize that there is no shame in quitting if they are concussed.

Continuing to fight in a concussed state, risks a more severe TBI. The initial signs of a concussion and traumatic SDH are entirely subjective such as headache, blurred vision, dizziness and confusion.8 The referee and the ringside physician(s) will not notice anything amiss unless the boxer brings it to their attention. By the time objective signs such as gross motor instability, ataxia, unequal pupils appear the head injury is usually advanced. So, the mantra that should be drilled into everyone (boxers, cornermen, referee, ringside physicians) should be "if you feel something, say something, do something".

Role of referee: In most Commissions around the world, the referee is the sole arbitrator of the fight. Hence it is important that every referee should be educated on recognizing signs and symptoms of concussion and SDH. It is the referee's responsibility to protect the boxer and stop the fight in a timely fashion. All referees should be required to complete mandatory concussion training. Refresher courses should be mandated every few years, often every two years. These courses should cover topics such as recognition of concussion signs and symptoms, how to assess a boxer for a concussion and taking care of a downed fighter.

Role of ringside physician(s): In some Commissions, the ringside physician can also stop the fight. This places an enormous responsibility on the ringside physician one not to be taken lightly. Ringside physicians should realize that they are ringside with the sole objective to protect the health of the two combatants. They are not there in the capacity of a fan of the sport and should have a low threshold of stopping the fight if they suspect an acute concussion or a more severe TBI. A ringside physician should stop a fight on medical grounds in a timely fashion, neither too early certainly never too late. Stopping a fight on time is a skill which is learned through experience by working ringside. This experiential medical learning is an art acquired though practical experience and application rather than formal didactic lectures or reading a textbook of neurology.

Enhanced safety protocols: Commissions such as the New York State Athletic Commission (NYSAC) have been in the forefront of devising and implementing protocols to protect the health of the combatants in the ring. Some of these protocols include:

- Close screening of all boxers to determine their medical and neurological fitness to fight. Leading up to a fight, boxers need to submit to the Commission's attention blood test results (complete blood count including platelet count); negative serology for blood borne infections such as hepatitis B, hepatitis C, HIV; 12-lead electrocardiogram (EKG); ophthalmological evaluation carried out by a board certified ophthalmologist (evaluation from optometrists, advanced care providers such as nurse practitioners, physician assistants are not accepted); MRI brain without contrast (CT scan head is not accepted unless the boxer has an absolute contraindication to MRI scanning). The Commission has established standards with respect to neuroimaging. MRI brain without contrast must be carried out on a 1.5 Tesla (T) or 3 T magnet and must include the following sequences: Susceptibility weighted imaging (SWI); T1 weighted images; T2 weighted images; FLAIR; Diffusion weighted image (DWI); Gradient echo (GRE). The reason for requesting multiple sequences is to ensure that the scan picks up stigmata of prior neurological injuries such as hemosiderin deposition in the brain and gliosis.9 The Commission currently requires MRI scan within 3 years of any bout. A scan which shows evidence of prior TBI is grounds for disqualification of the fighter and denial of license to fight in New York State. The Commission revisits its minimal medical requirements for licensure on a regular basis and there is an ongoing debate to reduce the MRI scan requirement to within 1-2 years of any bout. The Commission physician may request additional testing such as magnetic resonance angiography (MRA) head if concern for a vascular malformation is raised on initial screening MRI. The Commission has well defined rules with respect to incidentally detected intracranial vascular malformations. Fighters with brain aneurysms, arteriovenous malformations and cavernomas are denied license to fight. All MRI scan reports are closely evaluated by the Commission medical staff. If any concern is raised about the quality of the scan or the interpretation of the same by the radiologist, a repeat scan is requested. In such cases the boxer is instructed to get this scan done from a reputed radiological facility preferably attached to a large academic medical center.
- All fighters undergo a rigorous weigh-in physical where they are examined by experienced certified ringside physicians. During the weigh-in physical, close attention is given to the fighter's hydration status. Signs and symptoms of concussion sustained while in the training camp are actively screened for.
- Every event is well staffed with respect to the number of ringside physicians, emergency medical personnel (EMS) and ambulances.
- Prior to the fight, the nearest Level I trauma center from the arena is determined and the staff in the emergency department is made aware of the fight in their vicinity. This ensures that all necessary medical specialists such as neurosurgeons are available in case of a medical emergency.
- Prior to the fight, the medical evacuation route from the ring to the ambulance is determined and communicated to all physicians, inspectors and deputy commissioners. This is the route that is to be taken in event of medical evacuation of a downed fighter from the ring. Predetermining this route ensures that there is a timely and smooth evacuation from the ring to the ambulance.
- One ringside physician is assigned to the red corner and another assigned to cover the blue corner. Between rounds the doctors on each corner step on to the ring canvas, stand outside the ropes and closely observe the fighter for signs of concussion/ TBI.
- Between rounds the referee is instructed to walk to each corner to have a look at the fighter. During this one-minute break between rounds, active bi-directional communication between the referee and the ringside physician is encouraged. If there is any concern raised about the fighter's health either by the referee or the ringside physician, a time out is requested. The referee signals for the next round to start immediately calls time indicating stoppage of action. The uninjured fighter is signaled to go to the neutral corner while the injured fighter is walked over to the ringside physician for evaluation. Based on the evaluation by the ringside physician, either the fighter is cleared to proceed, or the fight is stopped on medical grounds.
- After the fight is over, all fighters undergo a detailed post-fight medical evaluation. Any fighter with a Glasgow Coma Scale (GCS) of less than 13 and/or displaying signs of an acute concussion/ TBI is immediately transferred via on-site ambulance to the trauma center for neuroimaging and evaluation.
- A boxer who is concussed but otherwise stable with a GCS score of 13 and above is red flagged. This fighter is closely observed for the next 15 to 30 minutes. During this time, serial neurological evaluations are carried out. A boxer who remains stable with no neurological signs or symptoms such as gross motor instability

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(ataxia), headache, dizziness, vomiting is discharged from the venue with advice to go to the nearest emergency department if any of the above signs were to manifest later. A combatant who becomes symptomatic over the course of the observation period is sent via an ALS ambulance to the nearest designated Level I trauma center for neuroimaging (CT scan head), evaluation and management.

- All boxers who are injured are given an adequate period of medical suspension. Boxers who suffer a KO due to a headshot are suspended for a minimum period of 90 days and clearance from a neurologist is requested prior to returning to sparring and competitive boxing. This 90-day period and neurological clearance ensures that the boxer gets sufficient time to recover from the concussive head injury. It also ensures that a potentially "still concussed" boxer does not fight prematurely in another jurisdiction risking a traumatic SDH.

Role of Commission officials, promotors and sports governing bodies: to protect boxers from dying from traumatic SDHs shall require a collaborative effort involving all stakeholders. Health and safety of boxers needs to be the primary objective of all concerned parties. The role of good match making in this regard cannot be overemphasized. The goal should be to have fair and competitive fights by pairing boxers with similar skill levels, records and weight classes. There should be active ongoing dialogue to attempt to make sport safer with rule changes such as limiting the number of shots to the head, limiting the total number of rounds in a championship fight and placing limits on the number of times a fighter can fight in a year.10-12 This will require collaboration, discussion and consensus among various stakeholders including Commissions and sports governing bodies such as IBF (International Boxing Federation), WBA (World Boxing Association), WBO (World Boxing Organization) and WBC (World Boxing Council) (which govern professional boxing) as well as IBA (which produces detailed technical and competition rules governing amateur boxing worldwide).

Conclusion

Traumatic SDH remains the most common cause of boxing-related mortality. As things stand now, young boxers continue to perish in the ring from this preventable head injury. Those who survive are left behind with permanent disabling neurological deficits, very poor quality of life and at times a fate worse than death. In no sport should an athlete die. While boxing can likely never be made completely safe, it can certainly be made safer. This shall require a collaborative effort involving all stakeholders. Commissions like NYSAC have prioritized health and safety of combatants who fight under its jurisdiction by enacting practical sound policies grounded in science. Some of these policies are highlighted in this commentary. They should be universally adopted by boxing commissions in the United States and abroad.

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