



Boxing

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13.1 Introduction

Boxing is a popular sport and enjoys a large fan base across the world (Fig. 13.1). Combat sports medicine is a nascent but rapidly evolving field of medicine dedicated to the care of the combat sports athlete. While this chapter will discuss principles applicable to all combat sports, the chapter will focus on boxing injuries exclusively. Ringside physicians come from all disciplines of medicine and bring their unique skill set and knowledge to the ringside setting. A good ringside physician should be knowledgeable of all the

possible injuries that can be encountered during the course and in the immediate aftermath of a bout and skilled in managing these injuries. Figure 13.2a, b shows the dynamic of boxing combat. This chapter shall give a broad overview of combat sports medicine as it relates to boxing and cover commonly encountered boxing injuries, their timely recognition, and management.

Since there are limited evidence-based medicine studies in combat sports medicine, many of the recommendations in this chapter are based on the collective anecdotal experience of seasoned ringside physicians. The Association of Ringside Physicians (ARP) (<https://ringsidearp.org/>) is an international non-profit organization dedicated to the medical care and safety of combat sports athletes and is a continual source of expert opinion and evidence-based guidelines on topics unique to combat sports medicine. Certification as an ARP ringside physician is available through an examination jointly administered by the American College of Sports Medicine and the Association of Ringside Physicians.

This chapter addresses boxing injuries that apply to both professional and amateur boxing. Due to differences between the two levels in terms of regulations and the format of competition, differences in the types and prevalence of injuries and risk factors exist between the two. Amateur boxing matches are shorter in time duration (2 minute rounds versus 3 minute rounds) and number of rounds. Headgear is typically worn in

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Fig. 13.1 (a) Overhead view and (b) Ringside view of the ring during boxing combat. (Photo credit George Velasco MD)

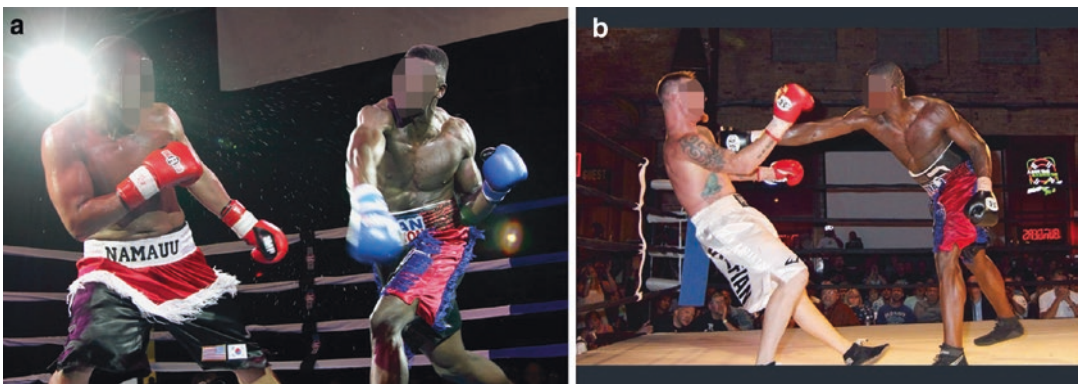


Fig. 13.2 Dynamics of boxing combat. (Photo credit Donald A. Muzzi DMD, MD)

amateur competition, whereas it is not in professional competition. While risks associated with injury exist at both levels of boxing competition, a systematic review of observational studies completed in 2007 by Loosemore et al. concluded that there is no strong evidence to associate chronic traumatic brain injury with amateur boxing [1].

The pre-participation medical testing requirements in amateur boxing vary as compared to those required by commissions regulating professional boxing bouts. Most amateur competitions around the world require only an annual physical exam for participation.

13.2 Medical Clearance of the Professional Boxer Prior to Competition

Evaluation of the professional boxer begins long before he/she actually steps into the ring. Most

commissions in the United States and across the world require mandatory tests at the time of initial licensure to fight. Medical requirements for licensure vary from state commission to commission but in general include blood tests, an ophthalmological evaluation, a neuroimaging test, and an electrocardiogram (EKG). This may not be true in some countries, and there may be variations in the specific requirements between jurisdictions [2].

13.2.1 Blood Tests

Most commissions in the United States require tests for hepatitis B, hepatitis C, and HIV both at the time of initial licensure and at varying frequency thereafter. Many commissions also require female boxers to undergo a pregnancy test prior to competition. Some commissions require a complete blood count (CBC) including

platelet count at the time of the initial licensure. Additionally, some commissions also require a prothrombin time and international normalized ratio (PT/INR). The goal is to detect any coagulopathy which may make that boxer more susceptible to bleeding. Given the current circumstances commissions may start to require pre-bout testing for the COVID-19 virus. This could also involve other testing for pathogens in the event of any pandemic [2–4].

13.2.2 Ophthalmological Evaluation

Nearly all commissions in the United States require an ophthalmological evaluation by a certified ophthalmologist at the time of the initial licensure and periodically thereafter [2, 5]. The goal is to ensure ophthalmological fitness to fight. Ophthalmological fitness criteria to fight vary from commission to commission but generally include the following [5]:

1. Boxers who have had surgeries which alter the structural integrity of the globe are contraindicated for participation in combat sports. Such surgeries include, but are not limited to: cataract surgery and implantation of intraocular artificial lenses.
2. Boxers who have had radial keratotomy are not permitted to compete.
3. Boxers must not present with “Major Ocular Pathologies” such as: anterior chamber angle abnormalities, glaucoma, lens abnormalities, peripheral retinal abnormalities, macular abnormalities, diplopia or extraocular muscle palsy, or active inflammation.
4. Boxers must have uncorrected visual acuity of 20/200 or better in each eye.
5. Boxers must have corrected visual acuity of 20/40 or better in each eye.

13.2.3 Special Considerations: LASIK

LASIK surgery is associated with a recognized increased risk of corneal injury (flap dislocation) after eye trauma. Due to the recognized increase

risk of corneal injury in boxing, boxers are discouraged from undergoing elective LASIK surgery and should be made aware of the potential complications if they decide to participate in the sport. Some commissions do not allow boxers who have undergone LASIK procedure to participate in competition.

13.2.4 Special Considerations: Intraocular Surgery (E.g., Cataract and Retinal Detachment)

In the event of previous eye surgery, these cases should be dealt with an individual case-by-case basis. Medical clearance from an ophthalmologist to fight is required.

13.2.5 Utility of Neuroimaging in Boxing

Neuroimaging serves three distinct roles in the individualized care of the boxer.

1. Neuroimaging prior to licensure helps to identify and/or exclude coincidental or clinically suspected brain lesions which may pose a risk for rupture, bleeding, or other catastrophic brain injury during the course of the bout, representing a step towards personalized medicine and individual risk stratification of a boxer [6, 7].
2. Neuroimaging in the immediate aftermath of a bout primarily serves to rule out acute life-threatening traumatic brain injury.
3. Neuroimaging may also be carried out to assess for evidence of structural brain injury/changes which may make a boxer more likely to express late-life neuropsychologic sequelae of brain injury, such as chronic traumatic encephalopathy (CTE), or dementia pugilistica/punch drunk syndrome. Serial neuroimaging could possibly help identify these at-risk athletes if progressive structural and functional changes are present over time. In these athletes, structural and functional neuro-

imaging plays a prognostic role and aids in determining whether the combatant should be allowed to continue to participate in future bouts [6, 7].

The risks for both acute and chronic traumatic brain injury are high in combat sports such as professional boxing, kickboxing, and MMA. Chronic traumatic brain injury has not been substantiated after amateur boxing careers, and there is a distinct difference in risk factors between amateur boxing and professional boxing. With that being said, all participants should be aware of the risks involved and be informed that it cannot be claimed that any amount of boxing is good for the brain [1].

Currently, there are no consensus neuroimaging guidelines for combat sports. Standardizing neuroimaging guidelines for licensure, with the goal of screening for both acute and chronic traumatic brain injury, could assist in protecting the boxer's health and safety, both in the ring, and after their professional careers have ended [6, 7].

13.2.6 Neuroimaging Prior to Licensure

Neuroimaging prior to licensure aids the clinical judgment of supervisory personnel (ringside physicians and commission officials) regarding whether the boxer should be allowed to participate in a future bout. It also helps identify and/or exclude coincidental or clinically suspected brain lesions that may pose a risk for rupture, bleeding, or other catastrophic injuries to the brain should a boxer participate in future bouts. These structural lesions include but are not limited to cerebral aneurysms, arteriovenous malformations, cavernous angiomas, mixed malformations, vein of Galen malformations, large venous malformations, large arachnoid cysts, posterior fossa arachnoid cysts, pituitary macroadenomas, and other space-occupying lesions or tumors. It is important to emphasize that the above represent a heterogeneous group of cerebral and cerebrovas-

cular lesions, which have different natural histories and propensities to bleed. A less urgent but equally important role of neuroimaging prior to licensure is to identify evidence of prior structural injury associated with brain trauma, which may make a boxer more likely to express late-life neuropsychiatric sequelae of brain injury such as chronic traumatic encephalopathy (CTE), dementia pugilistica, chronic post-concussion syndrome, posttraumatic dementia, posttraumatic cognitive impairment, posttraumatic parkinsonism, and chronic posttraumatic headache. This information allows the physician and boxer to make decisions about the boxer's future brain health, implication for, and risk of future neurologic sequelae particularly when the athlete's clinical history is ambiguous [6, 7].

Either a computed tomography (CT) or magnetic resonance imaging (MRI) of the brain is currently included in the process of registering for a license to compete in combat sports in some jurisdictions in the United States and around the world. The imaging specifics and frequency vary widely, with some commissions requiring an MRI brain scan every 1–5 years and others only once, i.e., at the time of licensure. Some commissions do not require any imaging prior to licensure. Other commissions only require imaging if a combatant is of a certain age or deemed “high-risk” [8]. Classification of what makes a combatant “high-risk” also varies considerably from commission to commission, but usually is related to age (usually >40 years), period of inactivity (usually >1 year), and/or recent loss/multiple losses (usually >10). Some commissions detail the required MRI imaging sequences and specifically request sequences such as susceptibility weighted imaging (SWI) and gradient echo imaging (GEI) which have high sensitivity for prior traumatic brain injury (TBI). Some commissions require that all combat sports athletes undergo a magnetic resonance angiogram (MRA) of the brain in addition to an MRI of the brain at the start of their professional career (time of licensure) to primarily exclude any incidental vascular malformations of the brain [6, 7].

13.2.7 Electrocardiogram

Some commissions require an electrocardiogram at the time of the initial licensure to fight. Boxers are usually young healthy individuals with low risk of pre-existing cardiovascular pathology. The goal of the electrocardiogram is to detect that rare combat sports athlete who may harbor a tendency to a malignant cardiac arrhythmia and risk of sudden cardiac death in the ring. In amateur boxing, electrocardiograms are not routinely required. However, if the amateur boxer's history or physical exam suggest the possibility of a disqualifying condition or problem, further testing such as an electrocardiogram will be required [9, 10].

13.3 Evaluation of the Boxer Before, During, and After Competition

13.3.1 Pre-bout Evaluation of the Boxer

Medical evaluation of the boxer can take place at the time of the weigh-in which is usually a day before the fight (referred to as the weigh-in physical) or on the day of the fight itself (referred to as the pre-fight physical). At the time of the weigh-in physical, the ringside physician conducts a complete physical examination, neurological examination, and auscultation of the heart and the lungs. The medical history is reviewed and so are the results of the imaging, electrocardiogram, ophthalmological evaluation, and blood tests. Particular attention is given to the boxer's hydra-

tion and cardiovascular status. Boxers sometimes cut weight to fight at the predetermined weight. This weight-cut can be drastic, and the boxer could present with clinical signs of dehydration. Permitting such a boxer to enter the ring can threaten his/her health and safety. During the physical exam, the ringside physician should also look for any unhealed lacerations, active skin infections, and orthopedic injuries [2, 11, 12] (Fig. 13.3a).

13.3.2 Evaluation of a Boxer During a Bout

Close medical supervision of a boxer is advised during a fight (Fig. 13.3b). Boxers have died in the ring or in the immediate aftermath of a bout. The cause of death in these cases is usually neurological and acute subdural hematoma (SDH) is the most common cause of neurological morbidity and mortality. During a bout, the ringside physician should pay close attention and keep a mental tally of the number of head shots which a combatant is taking and the number of knock-downs. If the boxer is noted to exhibit signs of gross motor instability (gait is ataxic, broad based), incoordination, confusion, or disorientation, the fight should be stopped on medical grounds. In some commissions, only a referee can stop a fight, in others the referee or the ringside physician can stop a fight. The ringside physician should consider stopping a fight, if he/she cannot guarantee the health and safety of the boxer. A good medical stoppage is one which is done at the right time (neither too early, certainly

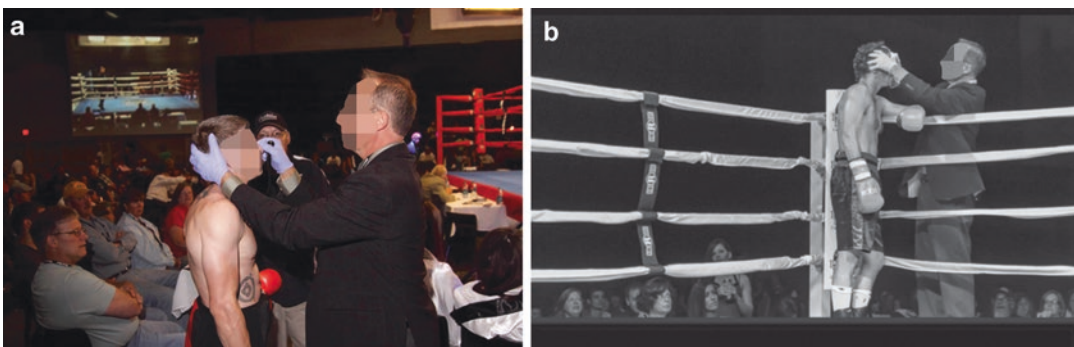


Fig. 13.3 Ringside physician assessing the boxer (a) after and (b) during a bout. (Photo credit Donald A. Muzzi DMD, MD)

never too late) and for the right indication. A bad medical stoppage is one done at the wrong time (either too early or too late) and for the wrong indication (such as a non-life threatening, non-vision impairing laceration) [13, 14].

13.3.3 Evaluation of a Boxer After a Bout

All boxers should have a post-fight medical evaluation. In the post-fight medical evaluation, the boxer is assessed for any injury he/she may have sustained during the course of the bout. At the time of the post-fight physical, the boxer should also be assessed for any facial fractures, lacerations, orthopedic injuries, or ophthalmic injuries. The neurological evaluation is the most critical aspect of the post-fight evaluation. The prime need for neuroimaging after a bout is to ascertain acute TBI. A CT scan of the head without contrast is the recommended imaging modality due to its relatively high sensitivity and specificity for identifying the presence of blood and bone fracture in the acute setting, its widespread availability, and short acquisition time. Based on the assessment by the ringside physician(s) after the post-fight physical examination, a boxer who is suspected of having sustained a TBI should be transported immediately by ambulance to the designated trauma center for an emergency assessment of possible TBI, an urgent CT scan of the head, and further care as deemed necessary by the trauma center physicians. Trauma center designation is a process outlined and developed at a state or local level, but the recommendation is that boxers in whom acute TBI is suspected be transported to a trauma center with access to specialist neurology and neurosurgery care [12].

13.3.4 Recommended Good Practice Guidelines Regarding Neuroimaging Requirements After a Bout

1. Based on the assessment by the ringside physician(s) after the post-fight physical

examination, a boxer who is suspected of having sustained a TBI should be transported immediately by ambulance to the designated Level I trauma center for an emergency assessment of possible TBI/concussion, an urgent CT scan of the head, and further care as deemed necessary by the trauma center physicians. Concern for TBI is raised if the combatant manifests or reports symptoms of headache, blurred vision, double vision, nausea, vomiting, balance, or gait issues after a bout.

2. Any boxer with a Glasgow Coma Scale/Score (GCS) of less than 13 on initial assessment, posttraumatic seizure, focal neurological deficit, and/or greater than one episode of vomiting since the suspected head injury should be urgently transported to the designated Level I trauma center via an on-site ambulance for a CT scan of the head (as per National Institutes of Health and Care Excellence (NICE) guidelines for determining the need for an acute CT scan of the head in adults following a traumatic head injury) [15].

13.4 Injuries in Boxing

13.4.1 Traumatic Brain Injury

Neurological injuries associated with boxing may either be acute or chronic.

Concussion is the most common acute traumatic brain injury (TBI) encountered in boxing. Milder grades of concussions are not associated with loss of consciousness. The recovery is usually rapid with the boxer returning to full consciousness usually in the ring itself. Detecting subtle concussions (sub-concussive injuries) is difficult in a sport where every punch thrown at the head is thrown with the intention of winning by causing a concussion (KO). Concussion or mild TBI may present with a wide spectrum of signs and symptoms. Cognitive functions may be affected and can include disorientation, memory problems, impaired concentration, or loss of consciousness. Behavioral changes include sleep problems, irritability, emotional lability, anxiety, psychomotor retardation, apathy, fatigue, and

Table 13.1 “Red flag” signs and symptoms of serious brain injury [18]

Glasgow Coma Scale <15
Suspected open, depressed or basal skull fracture
Cerebrospinal fluid coming out of nose or ears
Posttraumatic seizure
Focal neurological deficit on post-bout examination
>1 Episode of vomiting since the head injury
Pupillary abnormality
Progressive increase of concussion symptoms
Deterioration of mental status/overall condition

distractibility. Physical manifestations of acute traumatic brain injury include headache, dizziness, vertigo, nausea, vacant stare, impaired skills at their sport, gait unsteadiness, impaired coordination, diplopia, photophobia, hyperacusis, and concussive convulsion/impact seizure. The Glasgow Coma Score (GCS) is insensitive to assessing for milder grades of concussion and may be 15 in a concussed boxer. Any boxer with a GCS score scale of less than 13 should be transferred to the nearest Level I trauma center for evaluation and imaging (usually a CT scan of the head) [16, 17] (Table 13.1).

The possible long-term neurologic result of multiple concussions and sub-concussive injuries includes chronic posttraumatic headache, chronic posttraumatic dizziness, posttraumatic memory impairment, posttraumatic Parkinsonism, and chronic traumatic encephalopathy (CTE). In the boxing medical literature, CTE has also been referred to as dementia pugilistica or “*punch drunk*” syndrome. It is characterized by a constellation of cerebellar and extrapyramidal signs. Chronic TBI may not appear until many years after a professional boxer retires from competitive boxing. It may also occur in an active boxer who has had a very long career with many fights [16, 17, 19].

Head trauma may also result in endocrine dysfunction. Some traumatic brain injuries sustained during boxing may cause hypopituitarism, and it is believed that the known prevalence of TBI-induced hypopituitarism is underestimated. The physician should be suspicious of any neuroendocrine abnormalities in the aftermath of a TBI. Central diabetes insipidus is a complication of traumatic brain injury and could be induced by

a minor concussion with only headache and polyuria as the symptoms [20–23].

13.4.2 Further Discussion on Concussion and Return to Sport

The Association of Ringside Physicians has released a consensus statement on concussion management in combat sports which will be discussed here, as it is the most current and evidenced-based consensus on concussion management pertaining to boxing. If a boxer sustains a TKO secondary to blows to the head, it is recommended that he or she be suspended from competition for a minimum of 30 days. It is also recommended that the fighter refrain from sparring for 30 days as well. If a fighter sustains a KO without LOC secondary to blows to the head, it is recommended that he or she be suspended for a minimum of 60 days. It is also recommended that the fighter refrain from sparring for 60 days as well. If a boxer sustains a KO with LOC secondary to blows to the head, it is recommended that he or she be suspended from competition for a minimum of 90 days. It is also recommended that the fighter refrain from sparring for 90 days as well [18].

Boxers may participate in non-contact training and conditioning 1 week after sustaining a concussion or loss via TKO/KO secondary to head strikes provided his or her symptoms are improving and do not increase in severity with activity. A gradual activity progression of increased intensity is recommended, starting with light aerobic activity progressing to a more rigorous/combat sports-specific activity and finally sparring when symptoms have completely resolved. Under no circumstances should a combat sports athlete compete or engage in sparring activity or competition if he or she is experiencing signs and symptoms of concussion. A boxer’s suspension should continue until a specialist physician trained in concussion management clears the fighter. Specialist physicians trained in concussion management include neurologists, neurosurgeons, and primary care sports medicine physicians [18].

13.4.3 Lacerations

Facial lacerations occur when the skin is compressed and dragged against the bony surfaces of the skull. Areas most prone to lacerations are the eyebrow area and cheekbone area because of the underlying bony structures (Fig. 13.4). Since the face and the scalp have a high degree of vascularization, lacerations tend to bleed profusely. Lacerations involving the nasolacrimal duct on the medial side of the orbit and the tarsal plates need close attention. Damage to the nasolacrimal duct can have long-term effects if the tear mechanism becomes damaged. Damage to the tarsal plates can permanently affect blinking (Fig. 13.4a, b). Simple lacerations can be sutured at the venue itself. Complex lacerations should be sutured in the hospital by a qualified physician. The boxer who has suffered a laceration is administered a medical suspension to allow time for the laceration to heal [2, 24].

13.4.4 Orthopedic Injuries

Hand injuries are common in combat sports. A common hand injury is the disruption of the metacarpophalangeal joints in the fingers. This is sometimes colloquially called “boxer’s knuckle.” The most common and most severe case of this is extensor hood disruption. When this occurs,

immediate surgery is needed to fix the extensor unit, preventing permanent damage and restoring function. Recurrent, untreated cases can result in disabling traumatic arthritis. Another common hand injury in boxers is disruption and destabilization of the carpometacarpal joints in the fingers. This is also sometimes called “carpal boss.” Severe cases require selective carpometacarpal joint arthrodesis. Injuries involving the upper limbs such as shoulder dislocation, rotator cuff tear, metacarpal fractures, and distal biceps tendon rupture are also encountered. The lower limb injuries that are more frequently reported include tears of the ligaments and menisci of the knee, and ankle sprains [17, 25–27].

13.4.5 Ophthalmological Injuries

Boxers may suffer corneal abrasions and retinal detachment both of which need evaluation and management by an ophthalmologist. If an orbital fracture is suspected, the ringside physician should rule out entrapment of the extraocular muscles. Such boxers should be referred to the emergency department for CT scan of the head, face, and orbits, and for management [28, 29].

The American Academy of Ophthalmology has issued recommendations on the prevention of eye injuries in boxing (see Table 13.2).

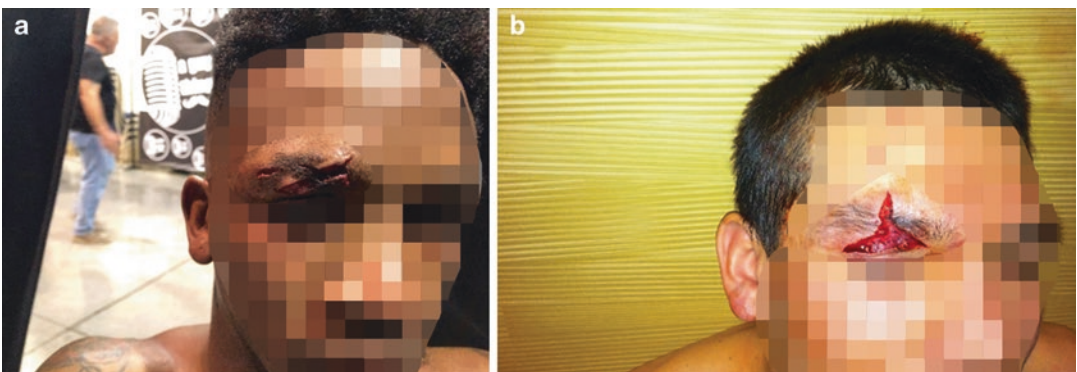


Fig. 13.4 (a, b) Cuts on the eyelid may damage the tarsal plate and cause permanent damage that may affect blinking. (Photo credit for Donald A. Muzzi DMD, MD)

Table 13.2 Recommendations from the American Academy of Ophthalmology

Recommendations from the American Academy of Ophthalmology's 1990 policy statement "reforms for the prevention of eye injuries in boxing" [30]
Examination of boxers before licensure and then after 1 year, six bouts, or two losses, or at the stopping of a fight because of an eye injury, or at the discretion of the ringside physician
Mandatory, temporary suspension from sparring or boxing for specific ocular pathology—30 days for a retinal tear and 60 days for a treated retinal detachment, or individualized after consultation with the athletic commission medical advisory board
Minimal visual requirements of 20/40 or better in each eye and a full central field of not less than 30° on each eye
An ophthalmologist required on each state medical boxing advisory board
Thumbless boxing gloves to minimize ocular injuries
A National Registry of Boxers for all amateur and professional boxers in the United States that records bouts, knockouts, and significant ocular injuries
A program for training and recertifying ringside physicians
A uniform safety code

13.4.6 Urological Injuries

Hematuria could result from different causes. Direct trauma to the kidneys or bladder may be responsible for hematuria associated with contact sports such as boxing. Non-traumatic causes such as Nutcracker syndrome must also be considered whenever one sees hematuria. Exercise-induced hematuria is a benign diagnosis of exclusion and the symptoms should disappear within a week. In instances where the boxer's urine is red or brown, as opposed to gross hematuria, one must rule out myoglobinuria due to rhabdomyolysis. A boxer with gross blood in the urine after a fight should be closely evaluated and if needed referred to the trauma center for further management [31].

13.4.7 Oral and Maxillofacial Injuries

Any time there are fractures of the mandible present, there should be concern about potential airway obstruction. Malocclusion or failure of the mouth guard to fit properly may be signs of a

mandibular fracture. Edema, bleeding, and muscle movement may all cause upper airway obstruction. Injuries to that area also raise the possibility of a free-floating maxilla bone causing obstruction, dental evulsions, and possible aspiration of dental units or uncontrolled oral-pharyngeal bleeding that may partially obstruct the airway. Such complications underscore why a good mouthpiece is vital to the boxer's health and safety. Urgent situations in facial injuries include open fracture or cerebrospinal fluid rhinorrhea [32, 33].

13.4.8 Head and Neck Injuries

A fractured larynx will manifest with subcutaneous emphysema, hoarseness, a palpable fracture in the midline of the neck, and respiratory distress. Ventilation with the bag mask technique is always the first choice to ventilate a fighter in acute respiratory distress. Intubation of a fighter should be considered only if there is no other option. If intubation is unsuccessful an emergency cricothyrotomy can be considered. Cricothyrotomy should only be performed in an emergency when mask ventilation, bag ventilation, and intubation fail, and mental status and respiratory status continue to deteriorate. In all cases of airway compromise, an athlete should be transported to the hospital without delay. Early airway intervention could stave off the problems that would arise from delayed laryngeal edema or laryngeal hematomas. One must always try to foresee possibilities that happen with the passage of time if there is prolongation of the transport to the hospital. Current non-urgent factors could transition to a true respiratory emergency. The most dangerous orthopedic injury would be a cervical spine fracture from a direct blow to the head or neck. An airway needs to be established in the unconscious apneic boxer. Once an airway is created, ventilate, and oxygenate [32, 33].

Rupture of the tympanic membrane is also possible during sparring or a bout. The boxer may notice sudden unilateral hearing loss in the ear and complain of dizziness. If the rupture is small, it may not be seen on regular oto-

scopic exam. Immediate evaluation should look for any ear or nasal drainage of CSF. Further evaluation should include hearing tests at baseline as well as during follow-up to assess recovery [34].

13.4.9 Thoracic Injuries

It is important to be vigilant for rib fractures. A rib fracture is not emergent but could interfere with respiration and lead to atelectasis or pneumonia. However, rib fractures that cause splenic rupture or tension pneumothorax create an emergent situation. In the case of a tension pneumothorax, do not wait for transport. Insert a 12 or 14 gauge angiocath needle into the second intercostal space in the midclavicular line on the side of the pneumothorax. For this reason, the physician should have a 12- or 14-gauge needle readily available during the bout. After needle decompression, the fighter should be immediately taken to a trauma center for a chest tube. Commotio cordis can happen from blunt trauma to the chest causing cardiac arrest from arrhythmia. Because of that, there should be emergency medical personnel and automatic external defibrillators present at all boxing events [9, 32].

13.4.10 Abdominal Injuries

As far as abdominal injuries, possibilities include hepatic contusion or laceration, and splenic rupture. During the pre-bout evaluation the physician should have looked for history of coagulopathy or infectious mononucleosis. Splenic injury is an emergency that requires a “swoop and scoop” approach for immediate transfer to the hospital. Renal contusion may occur with or without hematuria. Pregnant women cannot box due to potential trauma to gravid uterus, and so a pregnancy test is part of any complete pre-bout evaluation for female athletes. When there is possible blunt scrotal trauma, consider hematocele or testicular torsion. Testicular torsion is an emergency and the boxer needs to go to the hospital to get a duplex Doppler ultrasound [32].

13.5 Prevention of Boxing Injuries

According to a study done by Potter et al. examining boxing injuries resulting in a visit to a US hospital emergency department from 1990 through 2008, the rate of injury was 12.7 per 1000 participants. Those injured boxers were mostly male (90.9%). The most common diagnosis in the study was fracture (27.5%), and the most common body regions injured were the hand (33.0%) and head and neck (22.5%). In their study, punching bag-related injuries accounted for 36.8% of boxing injuries [35].

Sparring should take place with the use of oversized gloves. Boxers who have not fought for over 12 months should not fight more than ten rounds. The question of inactivity raises concerns about the likelihood of increased risks of injuries based on inactivity and conditioning. A minimum of two ringside physicians should attend every boxing match [36].

The Association of Ringside Physicians supports and recommends the use of custom-fit mouthpieces to aid in the prevention of orofacial trauma. In addition, the Association of Ringside Physicians has made a consensus statement on the utility of headgear during amateur boxing competition: There are fewer head and facial injuries when using headgear in amateur boxing and eliminating headgear will make amateur boxing less safe. Headgear protects boxers against lacerations during competition and sparring [37, 38].

Conclusion

Boxing is a combat sport with a high risk of injuries to the head and extremities. Close medical supervision as outlined above helps to protect the health and safety of the boxer.

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