

# Bobbing, weaving, collapsing and dying-preventing boxing deaths in the ring

## Abstract

**Background:** Professional boxing is a popular combat sport around the world. It is unfortunately also a sport which carries a very high risk of concussion and more severe forms of traumatic brain injury (TBI). In a sport where every punch thrown to the opponent's head is thrown with the intention of winning by causing a knockout (KO), TBI is an omnipresent danger. Traumatic subdural hematoma is the most common cause of boxing related mortality. The boxer either collapses in the ring during the fight or in the immediate aftermath of the fight.

**Discussion:** Boxers with traumatic epidural and subdural hematoma often have a lucid interval and then exhibit rapid at times precipitous neurological deterioration as the hematoma expands. Rapid loss of consciousness follows leading to a comatose state. Development of brain edema and secondary ischemic injury are the other substrates of delayed neurological deterioration.

**Conclusion:** Both the referee and the ringside physician (s) should be aware of this clinical presentation of acute TBI so that the fights can be stopped in a timely fashion, neither too early but certainly never too late! Innovate solutions can help prevent tragedies in the ring.

**Keywords:** boxing, combat sports, concussion, traumatic brain injury, lucid interval, malignant cerebral edema, second impact syndrome

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## Introduction

Professional boxing is a sport in which head impact exposures (HIEs) are common. Every punch thrown to the opponent's head is thrown with the intention of winning by causing a knockout (KO). On May 6th, 22-year-old Filipino boxer Kenneth Egano collapsed in his corner while waiting for the scorecards of an eight-round fight in which he was later declared as the unanimous decision winner. He was stretchered off and rushed to the hospital where he later succumbed to brain hemorrhage. He had a final record of 7-1, with 3 knockouts.

## Discussion

Kenneth's tragic death has once again highlighted that TBI is an omnipresent danger in boxing.<sup>1</sup> Boxers who suffer catastrophic TBI usually collapse in the ring and succumb to their injury in the following days. Traumatic subdural hematoma is the most common cause of boxing related mortality.<sup>2</sup> The lucid interval refers to a period of temporary improvement in a patient's condition following a TBI after which the condition deteriorates usually precipitously. The cause of the precipitous and often fatal neurological deterioration is thought to be rapid expansion of the hematoma and brain swelling. While classically described in reference to peridural (subdural and epidural) hematomas, lucid interval may also occur with cerebral contusions/intracerebral hematomas and may last from minutes to hours.<sup>3</sup> These are patients who 'Walk, Talk and Die'.

## Bobbing, weaving, collapsing and dying

Boxers 'Bob, Weave, Collapse and Die'. A thoughtful analysis of tragedies in the ring reveals that most boxers collapse either in the later rounds (e.g. 7 or 8th round of an 8 round fight, 10 or 11th round of a championship fight) or in the immediate aftermath of the fight (as in the case of Kenneth Egano). This suggests that boxers who suffer peridural hematomas also exhibit a lucid interval during which they continue to demonstrate effective offense and defensive skills to

the satisfaction of the referee and the ringside physician. The fight is allowed to proceed till the boxer suffers a catastrophic neurological deterioration. Collapse in the ring is accompanied with loss of consciousness. The downed boxer may exhibit decelerate posturing, seizures and have focal neurological deficits such as unequal pupils. The peridural hematoma is usually accompanied by other intracranial injuries (frontal and temporal contusions and intracerebral hematomas) and the boxer may never regain consciousness. In a surgical series of patients with epidural hematomas, those patients who remained conscious up to the time of surgery had a favorable outcome compared to those who were unconscious up to the time of surgery.<sup>4</sup> If the boxer survives, functional outcome is highly correlated with the Glasgow Coma Scale (GCS) score at the time of admission. Some boxers likely perish on account of diffuse brain swelling rather than the peridural hematoma itself. This 'malignant cerebral edema' at times documented after a minor head trauma in children and young adults is thought to occur due to loss of cerebral auto regulation mechanism.<sup>5</sup> In these cases the HIE does not cause immediate loss of consciousness and the signs and symptoms of brain swelling slowly evolve over a period of an hour to few hours. The 'second impact syndrome' a still incompletely understood and controversial concept may account for some deaths.<sup>6</sup> This syndrome described in young athletes playing contact and combat sports manifests as brief loss of consciousness, disorientation or headache following a HIE. Before the concussive symptoms from the first HIE resolve and after an interval that varies from within the duration of the sports event to a month or so out, another HIE (i.e., the 'second impact') occurs and within minutes' results in collapse and coma. Neuroimaging reveals severe brain swelling and in a few cases a small unilateral subdural hematoma with disproportionately severe ipsilateral brain swelling may be noted.

## Preventing tragedies in the ring

Preventing these tragedies in the ring will need innovative solutions and close collaboration between the various stakeholders

including but not limited to athletic Commissions, sports governing bodies and the combat sport athletic community. Since boxers 'Bob, Weave, Collapse and Die', there likely is a narrow window during which the fight if stopped may prevent the catastrophic neurological decline that follows. Reducing the number of rounds in a bout for non-championship fights to a maximum of 4 to 6 and for championship fights to a maximum of 10 may thus be a step in the right decision. To prevent 'second impact syndrome' all fighters at the time of the weigh-in physical should be asked about concussion sustained in training camp leading up to the fight. If the boxer exhibits post-concussion symptoms, he should not be medically cleared to fight. A boxer should be suspended for an adequate period of time following a concussive head injury. 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 a duration of 90 days. A neurology clearance from an independent neurologist should be requested prior to return to professional boxing. Boxers who do not experience loss of consciousness after a KO should be medically suspended for duration of 30-45 days. 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. Concern for acute TBI is raised in a boxer who experiences prolonged or persistent loss of consciousness and retrograde/anterograde amnesia, vomiting, has complaint of headache, displays unsteadiness and inability to maintain stance and balance (Table 1). Concern for acute TBI is raised in a boxer displaying neurological signs such as depressed sensorium, disorientation to person, place, and time, Glasgow coma scale (GCS) less than 13, unequal pupils (one pupil is dilated and does not react to light), focal neurological examination, incoordination and ataxia (Table 2). Lastly ringside physicians should remember that when it comes to acute TBI management and prognosis, time=brain. For a boxer 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 and early management by neurology and neurosurgery physicians.

**Table 1** Symptoms that raise concern for acute traumatic brain injury in a boxer

S.no	Symptoms
1	Prolonged or persistent loss of consciousness (>30 minutes)
2	Prolonged or persistent retrograde/anterograde amnesia
3	Vomiting
4	Complaint of headache
5	Unsteadiness and inability to maintain stance and balance

**Table 2** Neurological signs of acute traumatic brain injury in a boxer

S.no	Neurological signs
1	Depressed level of alertness and sensorium
2	Disorientation to person, place, and time
3	Glasgow coma scale (GCS) less than 13
4	Unequal pupils (one pupil is dilated and does not react to light)
5	Focal neurological examination
6	Incoordination and ataxia
7	Decerebrate posturing
8	Post-impact seizure

## Conclusion

Boxers who suffer traumatic peridural hematomas exhibit a short lucid interval during which they may exhibit effective offensive and defensive skills and continue to 'bob and weave'. Both the referee and the ringside physician (s) should be aware of this clinical presentation of acute TBI so that the fights can be stopped in a timely fashion, neither too early but certainly never too late!

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## Conflicts of interest

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