

Key points from the presentation: “Pearls in Neurological Evaluation”, John Stiller, M.D.

#### ACUTE BRAIN INJURIES IN BOXING:

- Subdural Hematoma (SDH)
  - Probably the most common cause of death and disability from an acute injury.
- Diffuse Axonal Injury (DAI).
- Cerebral Contusions.
- Subarachnoid Hemorrhage (SAH)
- CONCUSSION

#### Mechanism of Brain Injury:

- Shearing Forces
  - With blunt head trauma injury is proportional to the degree the head/brain is accelerated.
  - Force = Mass X Acceleration.
  - These forces (particularly angular acceleration) may result in.
    - SDH from tearing of bridging veins.
    - Concussion via effect on the brain stem and other areas of the brain
    - Other Intracranial Injuries.

#### DEFINITIONS OF CONCUSSION:

- Any trauma induced alteration in mental status that may or may not include loss of consciousness (AAN).
- Any trauma induced alteration in BRAIN FUNCTION that may or may not include loss of consciousness (adapted from AAN).
- A clinical syndrome characterized by the immediate and post-traumatic impairment of neural function such as alteration of consciousness, disturbance of vision or equilibrium, etc. due to brain stem dysfunction. (Congress of NS).
- A trauma induced change in mental status with confusion and amnesia with or without a brief LOC.

#### Several important points about concussions:

- May be caused by either a direct blow to the head or another mechanism that results in an “impulsive” force transmitted to the head.
- It may be associated with neuropathological changes; however the acute symptoms essentially reflect a physiological as opposed to a structural injury.
- Conventional neuroimaging is normal.
- LOC is not necessary for the diagnosis

#### COMMON CLINICAL SYMPTOMS OF CONCUSSION:

- Loss of Consciousness (LOC) or alteration of consciousness (e.g. “dinged”)
- Confusion (inability to think with ones customary clarity, coherence and speed)
- Amnesia
- Attentional deficits
- Headache
- Dizziness
- Blurred vision
- Nausea

#### Motor Manifestations of Concussion:

- Tonic Posturing and/or Clonic Movement.
- If these movements occur within 2 seconds of impact they do not indicate that the injury is any more serious than the same injury without them.

#### KNOCKOUT:

- A knockout in boxing is when a boxer does not arise from the canvas before a count of 10.
- When the knockout is from a punch to the head and the boxer has a loss of consciousness (usually brief) he most likely has a concussion with loss of consciousness.
- If there is no loss of consciousness he may have a concussion without loss of consciousness.

#### In other sports “On Field Evaluation for Return to The Game” (Can the boxer continue?):

- In boxing this needs to be done within one minute in between rounds.
- Consider:
  - The number and force of head blows up until that time. How well did he take a punch (e.g. did his legs buckle when hit with a jab...)
  - Observe gait and balance as boxer returns to his corner. Is he staggering or headed in the wrong direction
  - In the corner assess for alertness, confusion, speech problems (e.g. is it slurred), latency in answering questions,
- Communicate with the referee.
  - An experienced referee is part of a “team” and will often be able to tell you if a boxer is reacting differently to punches, defensively and to his commands.
- If possible meet and know about the boxers before the matches as this will be of particular help if a decision has to be made later to stop the fight for medical reasons.
  - Always err on the side of safety. Remember you are the boxer’s physician.

#### In between rounds:

- Try to assess reaction time and processing speed. If these are impaired the boxer will be at a significant increased risk for further injury.
- Do you want to continue?
  - Boxers rarely if ever answer “No”.
  - More often than not the ringside physician needs to “protect” the boxer from himself and unfortunately at times from the boxers own “corner”.
    - Orientation
      - What state/city are you in?
      - What arena (e.g. Blue Horizon)?
      - What day is it?
    - Check eyes including eye movements (e.g. “glassy eyed”, inability to fixate and follow)
    - If a boxer doesn’t answer you, while facing him say or have trusted interpreter say:
      - “If you don’t answer me the fight will be stopped.”

**CEREBRAL EDEMA:**

- Uncontrolled cerebral edema (malignant cerebral edema)
  - May ultimately cause death or severe disability
  - May initially appear benign
  - Clinically can resemble a concussion
    - Who needs to go to the ER?

How can we distinguish malignant cerebral edema from a concussion or other benign clinical state?

I)

- Headache (transient)
- Brief Confusion
- Amnesia that is improving
- Gradual improvement in general

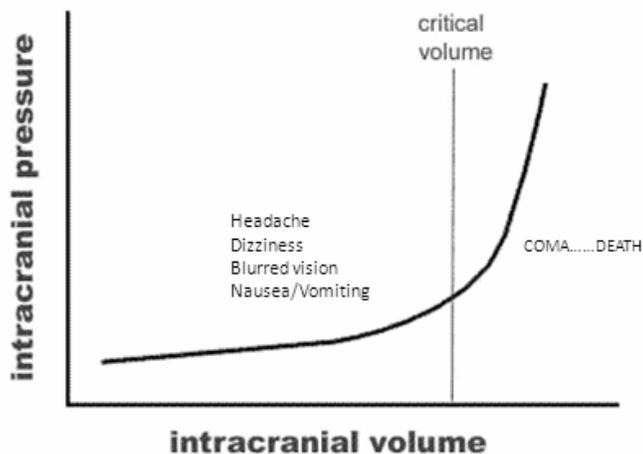
II)

- Prolonged headache or dizziness
- Confusion that is persistent or fluctuating
- Amnesia that is not improving
- Balance difficulty

I) More consistent with a concussion (benign course)

II) Increased probability of intracranial structural pathology (e.g. Edema, Bleed DAI)

The ICP/Volume curve below illustrates the difficulty in clinical assessment as there is an abrupt worsening with very little increase in edema once the limited compensatory mechanisms for alleviating ICP have been exhausted. Clinically this may present as an acute unexpected deterioration with coma or death.



#### Sore Loser or Encephalopathy:

- After losing a decision in a hard fought contest a boxer was agitated and threatening to the ringside physician. He refused the post fight examination.
  - Remember to consider this could be an agitated confusional state as the result of head trauma
  - Speak with those close to him and ask if this is the way he usually acts or is it unusual for him.
  - Assess as well as possible whether the fighter is confused.
  - Wait and reassess
  -

#### LONG-TERM AND CUMULATIVE EFFECTS OF SPORTS CONCUSSION ON MOTOR CORTEX INHIBITION

De Beaumont, Louis B.A.; Lassonde, Maryse Ph.D.; Leclerc, Suzanne M.D., Ph.D.; Theoret, Hugo Ph.D. *Neurosurgery* 61(2), August 2007, p 329-337

#### CONCLUSION:

Findings from this study indicate that sports-related concussions result in long-term motor system dysfunctions that seem to be attributable to subclinical intracortical inhibitory system abnormalities. This study also shows that sustaining subsequent concussions exacerbates this deficit, and thus provides additional support for the contention that the adverse effects of sports-related concussions on intracortical inhibitory systems are cumulative.