Anatomy & Physiology of Concussion

By:
J. Michael Randle, MD
I. Anatomy of the Brain
   A. Supporting Structures
   B. Lobes & Function
II. Mechanism of Injury
III. Pathophysiology of Concussion
Anatomy of the Brain
Supporting Structures

1. Skull
2. Dura
3. Cerebrospinal Fluid
Lobes of the Brain/Function

1. Frontal Lobes
2. Parietal Lobes
3. Occipital Lobes
4. Cerebellum
5. Medulla Oblongata
6. Brainstem
Mechanism of Injury

1. Brain surrounded by CSF to absorb light trauma
2. Because it “floats in CSF”, forces associated with rapid acceleration/ deceleration may not be absorbed by CSF
3. Forces may cause linear, rotational or angular movement of the brain or a combination.

4. The amount of Rotational movement (head turns around center of gravity) thought to be major force to cause concussion.
   - Brainstem most affected
   - Disrupts reticular activating system & therefore loss of consciousness
Pathophysiology of Concussion

A. Mild Traumatic Brain Injury (MTBI) or concussion

1. Can alter brain’s physiology for hours to weeks
2. Reversed quickly in majority of cases
3. However, a few brain cells may die
B. Sets off a cascade of events at the cellular level, beginning with impaired neurotransmission.
C. End result is a state of hyper metabolism requiring an increased amount of glucose.
D. However, blood flow is reduced & less glucose is available so at cellular level, “Energy Crisis”.
E. Brain Dysfunction in concussion occurs over widespread area- diffuse rather than focal.
F. Structural or Functional?

- Changes usually not see on CT or MRI? Structural
- Dysfunction usually temporary? Structural
- “Concussion in Sport Group” (2001) decided concussion may result in structural changes but symptoms reflect functional disturbance rather than structural.
Cumulative Effects

- **Multiple Concussions**
  - Symptoms worsen
  - Longer recovery time
  - Increased risk depression
  - Loss memory
  - Three or more- 5-fold greater chance of developing Alzheimer’s Disease

- **Second Impact Syndrome**
  - Very rare but very real
  - Second injury days or weeks after initial, before symptoms resolve
  - Brain swells & can be fatal
Conclusion
Questions