Traumatic Brain Injury

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TBI clinic

- 17 yo female honor student, accepted to 4 year college, softball player
- Assaulted in cafeteria resulting in loss of consciousness. Taken to MCV and diagnosed with intracranial hemorrhage. Kept in ICU over weekend. DC’d home after weekend.
- Went back to school, things did not go well
- Memory problems, emotional issues, daily headaches, fatigue
Concussion misperceptions…

- Little ding…
- Got my bell rung…
- “I didn’t have a brain injury, I got a concussion”
- Everybody gets better by 7-10 days
- Kids do better than adults after injury
What is a Concussion?

CP Symonds, 1928 - *British Medical Journal*

Regarding Cerebral Concussion…

“the patient is completely unconscious and in a state of flaccid paralysis. In a severe case, the respiratory and cardiac functions may hardly continue. In a few minutes recovery begins; the visceral reflexes are the first to return, and vomiting is common at this stage. The other cerebral functions recover more gradually, and there may be complaint of headache, dizziness and giddiness, but at the end of 24 hours, in a typical case of concussion….

“Recovery should be complete”
What is a Traumatic Brain Injury (TBI)?

- A TBI is caused by a bump, blow or jolt to the head or a penetrating head injury that *disrupts the normal function of the brain.*
- Not all blows or jolts to the head result in a TBI.

- The severity of a TBI may range from “mild,” i.e., a brief change in mental status or consciousness to “severe,” i.e., an extended period of unconsciousness or amnesia after the injury.
- The majority of TBIs that occur each year are concussions or other forms of mild TBI.
TBI numbers

- Each year, an estimated 1.7 million people sustain a TBI annually.
- About 75% of TBIs that occur each year are concussions or other forms of mild TBI.
- While a MTBI is usually not life-threatening, this injury can have serious and long-term impact on a person’s cognitive, physical and psychological function.
TBI Numbers

- CDC Annual estimation
  - 473,947
  - ED visits account for more than 90%
  - 35,136 hospitalizations
  - 2,174 deaths

- Ages 15-17
  - Incidence of hospitalization 125/100,000
    - Langlois 2007, Greenwald 2003
How the brain is injured...

- Acceleration/deceleration/rotation
- “Egg inside a shell”
- Fracture?
What is happening during an injury?

- Concussion = Metabolic Crisis!
- During injury: potassium rushes out of cell, (toxic) calcium rushes in → metabolic dysfunction
- Leads to an energy crisis & massive release of neurotransmitters (leading to interference with cell communication)
- Things to avoid: another blow to head or increasing metabolic demands on brain
<table>
<thead>
<tr>
<th>TBI Symptoms</th>
<th>Thinking/remembering</th>
<th>Physical</th>
<th>Emotional/mood</th>
<th>Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty thinking clearly</td>
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<td>Headache</td>
<td>Irritability</td>
<td>Sleeping more than usual</td>
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<tr>
<td>Feeling slowed down</td>
<td>Nausea or vomiting (early on)</td>
<td>Fuzzy or blurry vision</td>
<td>Sadness</td>
<td>Sleep less than usual</td>
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<tr>
<td>Difficulty concentrating</td>
<td>Dizziness</td>
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<td>More emotional</td>
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<tr>
<td>Difficulty remembering new information</td>
<td>Balance problems</td>
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<td>Nervousness or anxiety</td>
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<td></td>
<td>Feeling tired, having no energy</td>
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Vestibular System
Concussion Management: Areas of focus

- Acute Management
  - Rule out more serious intracranial pathology
    - CT, MRI, neurologic examination primary diagnostic test

- Post Injury Management
  - Prevent against Second Impact Syndrome
  - Prevent against cumulative effects of injury
    - Less biomechanical force causing extension of injury
  - Prevent presence of Post-Concussion Syndrome

- Determination of asymptomatic status essential for reducing repetitive and chronic morbidity of injury
Second Impact Syndrome

- Worst case scenario
- Swelling caused by an injury before symptoms of first injury have subsided
- Can cause severe disability or death
- Luckily very rare

Maurice Stokes
- Former NBA player- ’55 Rookie of the Year (16 RPG)
- 3/12/58 in Minneapolis—mTBI
- 3 days later began feeling worse, suffered seizure on plane, fell into a coma
- Disabled for rest of life
Acute Management-sideline

- Medically evaluated onsite using EMT principles
  - Attention to Cervical spine
- SCAT2 (or similar)
  - Sideline evaluation tool
- Should not be left alone, serial assessments for next few hours to evaluate for deterioration
- No Same-Day Return To Play!
- Refer to appropriate medical setting
Management of TBI: Topics of concern

- Grading systems ineffective/not data based
  - “Little bit pregnant”
- CT and MRI usually “normal”
- Reliance on self-report
- Variability of clinician recommendations
- Lack of education and awareness of injury
TBI Clinic

- Medical evaluation
  - History and physical
  - Neurological exam
  - Balance exam
- ImPACT Testing
- Psychologist
- *Education Consultant*
- Therapy
- Case manager

PROVIDE **INDIVIDUALLY** BASED MANAGEMENT
What is ImPACT?

- Chuck Knoll
- UPMC
ImPACT: Design and Structure

- 20 minute computer test
  - Internet, Computer, Quiet room, Patient
- Designed to evaluate multiple aspects of cognitive functioning in brief time period
- Subtest measures multiple cognitive processes
  - Verbal and Visual memory
  - Cognitive speed
  - Interaction of Memory and Speed
  - Self-reported symptoms
MTBI Evaluation Timeline

- **Pre-season**
  - Baseline testing
  - School or clinic

- **TBI**
  - Remove from play

- **First follow-up**
  - 1-3 days
  - Evaluation in TBI clinic

- **Follow up testing as needed**
  - Return to school
  - Return to play
Top 5 Treatments

1. Cognitive rest
2. Cognitive rest
3. Cognitive rest
4. Cognitive rest
5. Cognitive rest
## Medical Treatments

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Medicine/Treatment</th>
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<tbody>
<tr>
<td>Sleep</td>
<td>Trazodone, melatonin, ambien, behavioral strategies</td>
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<tr>
<td>Mood</td>
<td>Psychotherapy, antidepressants (SSRI’s, TCAs), anxiolytics (SSRI’s, benzo’s)</td>
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<tr>
<td>Somatic syndromes (headache, dizziness, nausea)</td>
<td>Vestibular therapy, several med’s (calcium channel blockers, anticonvulsants, beta-blockers, antidepressants)</td>
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<tr>
<td>Cognitive symptoms (fogginess, difficulty concentrating, memory deficits, cognitive fatigue)</td>
<td>Neurostimulants (ritalin, amantadine, modafanil)</td>
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TBI Rehabilitation

- Maximize age appropriate function
- Minimize secondary impairment
- Compensatory techniques
- Environmental modification
- Education/advocacy
- Context-sensitive
TBI Rehab

- Balance
- Coordination
- Vestibular therapy
- Vision therapy
TBI-Rehabilitation-Memory

- Memory impairment
  - Improve recall
  - Memory practice
  - Use of organizational strategies
    - Mnemonics
  - Using teaching techniques to make learning more efficient
    - Backward chaining
    - Making use of compensatory techniques
      - Memory notebook
      - Electronic device
    - Avoiding purely verbal
  - Making use of structured activities in teaching
  - Increased repetition
Breaking tasks into problem solving steps

Structured environment

Structured expectations

Incentives for progress toward a goal

How long does it take to recover?

- Everybody is different!!!

- Risk factors for a more complicated recovery:
  - Age (younger is bad)
  - Migraine history and symptoms (headache with aura, photophobia, dizziness)
  - Learning disability
  - Repetitive concussion (?)
  - Gender (?)

- Symptoms predict protracted recovery:
  - Acutely: dizziness
  - Sub-acute: fogginess
Pressure to play

- Can’t trust a concussed athlete to diagnose their own injury
- Athletes notorious for hiding symptoms
- As many as 50% of athletes experience concussion symptoms per year but only 10% report having an injury
Return to play

1. Asymptomatic at rest
2. Asymptomatic with exertion (cognitive and physical)*
3. Normalization of ImPACT scores

Meet all three, may (talk about) return to play

*best if under a therapist or trainer guidance
Prevention

• SEATBELTS!
• HELMETS!!!
• Like mother/father, like child…
Helmets

- Wearing a bicycle helmet decreases the risk of serious brain injury by up to 85%. (Scheiber RA, 2001)

- Use of well-fitted helmet during high-risk sporting activities (horseback riding, rollerblading, hockey) also minimize the chance of sustaining a brain injury.
Reducing falls

- The AAP published guidelines in 2001 for environmental interventions that can minimize the risk of Pediatric TBI.
- These include:
  - Lowering height of playground equipment to no higher than 5 ft
  - Using ground materials such as rubber, sand or wood chips.
  - Installing safety bars on open windows
  - Using gates as a safety barrier for stairs.

Seatbelts reduce fatalities by 45% in passenger cars and by 60% in light truck for front-seat passengers. Combined with an airbag, driver fatality can be reduced by 80%. (SG-10,11)

Child safety seats, when properly installed and used, can reduce risk of death by 70% for infants and by 47% to 54% for toddlers, and seatbelts decrease the need for hospitalization by 69% for children age 4 years and younger. (SG-13)

Children should always be placed in the back seat of an automobile to minimize risk of injury from airbags.

Car seat size should be based on child’s weight and developmental age.

Seat belt adjusters should be used to adjust the angle of the shoulder strap to minimize risk of SCI and ABI.
Sports Safety

- Insist that safety comes first:
  - Teach and practice safe playing techniques.
  - Encourage athletes to follow the rules of play and to practice good sportsmanship at all times.
  - Make sure athletes wear the right protective equipment for their activity (such as helmets, padding, shin guards, and eye and mouth guards). Protective equipment should fit properly, be well maintained, and be worn consistently and correctly.

- Teach athletes it’s not smart to play with a concussion.

- Prevent long-term problems.

- Work closely with league or school officials.
Long-term Follow-up

- Essential
  - Children injured at young age may not demonstrate cognitive deficits until much later in life
  - Improvements may continue for a significant period of time
  - Alternative programs and living situations may be needed as child and parents age
Heads Up to Schools: Know Your Concussion ABCs

- A—Assess the situation
- B—Be alert for signs and symptoms
- C—Contact a health care professional

Concussions don’t only happen to athletes on the playing field.

http://www.cdc.gov/concussion/HeadsUp/schools.html
Questions?