Mild Head Injury in Sports

Oregon Brain Injury Conference
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Bryan Andresen, M.D.

Introduction

- Definition
- Evaluation/Imaging
- Psychology Studies
- Repetitive Injuries/Second Impact Syndrome
- “Post-Concussive Syndrome”
- Treatment/ “Return to Play”
- Conclusions

Concussion Definition

- Literally “To Shake Violently”
- “…a traumatically induced alteration in mental status, often manifested as confusion or amnesia that is not necessarily associated with loss of consciousness”.

- McCambridge et al. NEJM 2007;365:1787
Concussion is A Mild Brain Injury

- Transient Confusion
- Disorientation
- Impaired Consciousness
- Dysfunction of memory around the time of injury
- Loss of consciousness < 30 minutes

Oregon Data 2004-5 School Year

- 8,500 Injuries
- 678 Mild TBI

- CD Summary 12/12/06;55(25)
Oregon Mild TBI
High Schools 2004-5

<table>
<thead>
<tr>
<th>Sport</th>
<th>Concussions</th>
<th>Rate/1000 exposures</th>
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</thead>
<tbody>
<tr>
<td>Football</td>
<td>348</td>
<td>0.44</td>
</tr>
<tr>
<td>Girls soccer</td>
<td>96</td>
<td>0.35</td>
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<tr>
<td>Girls basketball</td>
<td>86</td>
<td>0.24</td>
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<tr>
<td>Boys soccer</td>
<td>72</td>
<td>0.23</td>
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<tr>
<td>Wrestling</td>
<td>34</td>
<td>0.12</td>
</tr>
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<td>Softball</td>
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<td>0.05</td>
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<td>Girls Volleyball</td>
<td>19</td>
<td>0.05</td>
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</table>

You Can’t See a Concussion

- “Coach, I’m fine, let me back in the game”
- “We don’t have head injuries on our team”
- Players may be embarrassed or not realize they have were “dinged” or have memory problems

Neuropsychological Study: West Point Cadets

- 483 Cadets
- Baseline Cognitive Tests
- Very Mild Concussion
- Intramural boxing

West Point Cadets, cont.

- No Loss of Consciousness
- No amnesia
- Dizziness, Balance, Vision—resolved by 24 hrs
- All Returned to Full Activity after 4 Days per Athletic Trainers

West Point Cadets, cont.

- Neuropsych Testing
  - 1 Hour and 4 Days after concussion
- Findings
  - Memory and More Complex Tasks OK
- Reaction Time:
  - Significantly Impaired at 1 Hour
  - No Cadet Normal at 4 days

Basic Question: What is the Pathophysiology?

- Mild Degrees of Diffuse Structural Change?…OR
- Reversible Functional Changes?
Animal Models of Mild TBI

- Mechanisms same as severe TBI, but simply less of it?
  - Axon injury
  - Decreased axonal transport
  - “Wallerian Degeneration”
  - Small veins torn
  - Frontal and Temporal Lobes at highest risk for contusion

Imaging of Brain after Mild TBI

- CT: 5% (Abnormal)
- MRI: 9%
- SPECT scan: 53%


- “Functional” or “f” MRI
- Brain activation/processing
- Images different for oxy- and deoxyhemoglobin
Imaging of Brain after Mild TBI

- fMRI Study of 18 Mild TBI Patients
- 12 Healthy Controls
- Auditory Processing Tests


fMRI Study Results:

- Task Performance Did Not Differ Between the 2 Groups.
- Mild TBI Group Had INCREASED Brain Activation
- Possible Explanation of Memory Complaints or “Cognitive Fatigue”

McAllister et al

Concussed Athletes fMRI

Additional Insights

- Jantzen study of concussed college football players
- One week after injury, psychological studies of memory, math, coordination tasks were normal
- fMRI images showed MARKED increases in activity in frontal, parietal and cerebellar lobes

fMRI study of **Symptomatic** Concussed Athletes
- Also showed fMRI abnormal brain activation—often outside normal areas (Right prefrontal)
- Even when working memory tasks were normal

**Second Impact Syndrome**
- Critical Review By McCrory 1998
- 17 Case Reports
- Very Little Data to Support This “Syndrome”
- Stay Tuned

**Post Concussive Syndrome**
- Develops in 2-15% of patients with Mild TBI
- A Cluster of Symptoms
  - Physical
  - Cognitive
  - Emotional/Behavioral Symptoms
Post Concussive Syndrome

- Multiple Symptoms
  - Poor Memory and Concentration
  - Irritability
  - Headaches or Neck Pain
  - Fatigue

Post Concussive Syndrome

- Symptoms, cont.
  - Depression
  - Anxiety
  - Dizziness
  - Increased Sensitivity to Light and Sound

Post Concussive Syndrome

- Controversial: “organic” vs. emotional/“psychological”
- Proposed DSM-4 Criteria
- Role of Chronic Pain?
- Role of Depression?
Evaluation
Should the Athlete have a CT Scan?
❖ Am Academy of Pediatrics:
   ❖ Presence of a skull fracture
   ❖ Depressed mental status
   ❖ Focal neurological deficits
   ❖ (Age < 3 months)

Kaji. NEJM 2007;356:1787

Evaluation
Neuropsychological Testing
❖ “Pencil and paper”
❖ ImPact, CogSport, other proprietary computer based assessment tools
❖ No “Gold Standard” but becoming more widely used.
❖ Baseline and after concussion

Treatment
❖ Return to Play Guidelines--Prague Guidelines:
   ❖ Individualized Evaluations
     ❖ Age of Athlete
     ❖ Type, Severity and Duration of symptoms
Return to Play Same Day?

❖ NO!
❖ If concussion suspected: No return to Play that day, ideally until cleared by an MD

Graduated Stepwise Return to Play Protocol—“Simple” Concussion
❖ 1. No activity, complete rest.
❖ 2. Light aerobic exercise: Walking, stationary bicycle, no resistance training
❖ 3. Sport specific exercise. Skating in hockey, running in soccer, progressive resistance training

Graduated Stepwise Return to Play Protocol, cont.
❖ 4. Non-contact training drills
❖ 5. Full contact training after medical clearance
❖ 6. Game play
❖ McCrory, et al
“Complex” or multiple concussions

- Rehabilitation more prolonged
- Ideally managed by doctors with expertise in management
- No Dogma

Education after TBI Mild TBI Helps

- Children with Mild TBI seen at 1 week given Informational Book Including:
  - Symptoms of Mild TBI
  - Coping Strategies
  - Advice on return to School and Sports

Education Helps

- Group Given Informational Booklet
  - Less Anxiety
  - Less Headaches
  - Fewer Sleep Problems
Prevention
- Helmets and protective gear
- Tackling
- Padding of fixed objects (goal posts)
- Education
  - CDC “Heads Up”
  - Injury Prevention program @ Oregon State Public Health Division
- BIA

Treatment—Post-concussive Syndrome
- Focus on Symptoms
- Supportive Counseling
- Pharmacologic Treatment
- Post-Traumatic Headaches
- Cognitive Rehabilitation and Compensatory Strategies

Helmets
- Forces--sensors
- Soccer headgear?
- New designs
Return to Driving

- Reaction Time required
- “Split second” decisions needed to drive

Conclusions

- Concussion is a Mild TBI
- Concussion management is changing and has become more “conservative”
- Schools should have a return to play policy and procedure in place
Local Services

- Neurologists, sports medicine specialists
- Physical Med. & Rehabilitation
- Psychologists, esp. Neuropsychologists
- PT/OT/ST with neuro training
- Community Rehabilitation Services of Oregon 342-1980
- UO Speech-Language Hearing Center 346-3593
- Oregon TBI Consulting Teams 346-0597
- Brain Injury Association of Oregon

Thank-you!