Mild Head Injury in Sports

Oregon Brain Injury Conference

3/1/08

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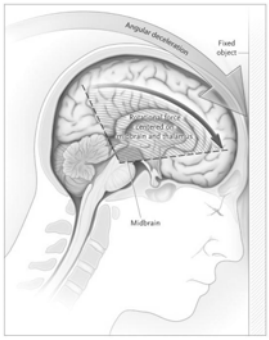
Introduction

- 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

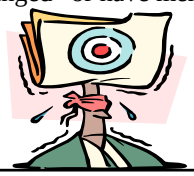
- CD Summary 12/12/06;55(25)

Oregon Mild TBI
High Schools 2004-5

Sport	Concussions	Rate/1000 exposures
Football	348	0.44
Girls soccer	96	0.35
Girls basketball	86	0.24
Boys soccer	72	0.23
Wrestling	34	0.12
Softball	13	0.05
Girls Volleyball	19	0.05

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

- Warden, et al. Persistent prolongation of simple reaction time in sports concussion. Neurology:57(3) August, 2001.

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%

Kant, et al. Tc-HMPAO SPECT in persistent post-concussion syndrome after mild head injury: comparison with MRI/CT. Brain Injury; 11(2)1997:115-124

Imaging of Brain after Mild TBI

- "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

McAllister et al. Differential working memory load effects after mild traumatic brain injury. Neuroimage. 2001 Nov:14(5):1004-12.

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

Jantzen et al. 2004 AJNR Am J Neuroradiolgy 25:738-745.

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
  - Chen et al. Functional abnormalities in symptomatic concussed athletes: an fMRI study. NeuroImage 22 (2004) 68-82

Second Impact Syndrome

- Critical Review By McCrory 1998
- 17 Case Reports
- Very Little Data to Support This "Syndrome"
- Stay Tuned
  - **McCrory, et al. Second Impact Syndrome. Neurology 1998;50:677-683**

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
  - McCrory et al. Summary and agreement statement if the 2nd International Conference on Concussion in Sport, Prague 2004. Br J Sports Medicine 2005; 39:196-204

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
    - Ponsford et al. Impact of Early Intervention on Outcome After Mild Traumatic Brain Injury in Children. Pediatrics. 2001;108(6)

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

LIDS ON KIDS

LIDSONKIDS.ORG
A HELMET - IT'S A SMART IDEA

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!