Initial Management and RTP Guidelines

Michael "Mac" McCuistion, ATC
Head Athletic Trainer – Lincoln East High School
OSMA 2009

CONCUSSION
Definition

- A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.
  1. Direct blow to the head region; impulsive force transmitted to the head.
  2. Rapid onset of short-lived neurological impairment that resolve spontaneously.
  3. Acutely, symptoms largely reflect a functional disturbance, rather than structural injury.
  4. Symptoms may or may not involve LOC, where resolution follows a sequential course, where some of which may be prolonged.
  5. No abnormality in standard structural neuro-imaging studies.

- Consensus Statement on Concussions in Sport: the 3rd International Conference on Concussion in Sport held in Zurich, November 2008. P McCrory, W Meeuwisse, K Johnston, J Dvorak, M Aubry, M Molloy & R Cantu, Br. J. Sports Med. 2009; 43;i76-i84, doi: 10.1136/bjsm.2009.058248

Classification

- No Simple vs. Complex
  - Unanimously supported the concept:
    - 80% - 90% resolve 7-10 days
    - Children and Adolescent longer

Classification

- No Standard Classification Guidelines
- Mechanisms however may help determine outcomes
- Mild, Moderate, Severe

Classification

- http://www.advertisementave.com/tv/ad.asp?u_player=realplayer&adid=30

Structure vs. Function

- Neuropathophysiology

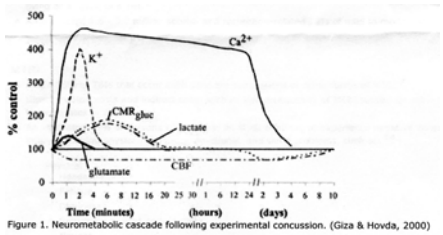
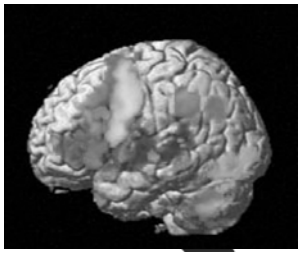


Figure 1. Neurometabolic cascade following experimental concussion. (Giza & Hovda, 2000)

Functional MRI (*f* MRI)

- A technique for determining which parts of the brain are activated by different types of physical sensation or activity, such as sight, sound or the movement of a subject's fingers.
  - "Brain Mapping"
  - Concussions



Neurometabolic Cascade

- Indiscriminate release of neurotransmitters
- Unchecked ionic fluxes
  - K^+ efflux
  - huge Ca^+ influx
    - ↓ mitochondrial oxidation
    - activates cell death mechanisms
- Neuronal depolarization
- ↑ Glucose metabolism
  - cellular energy crisis
- ↓ cerebral blood flow

State of Post-Concussive Vulnerability

Neurometabolic Cascade

- Indiscriminate Release of Neurotransmitters

BAD

Neurometabolic Cascade

- Unchecked ionic fluxes
  - K^+ efflux
  - huge Ca^+ influx
    - ↓ mitochondrial oxidation
    - activates cell death mechanisms

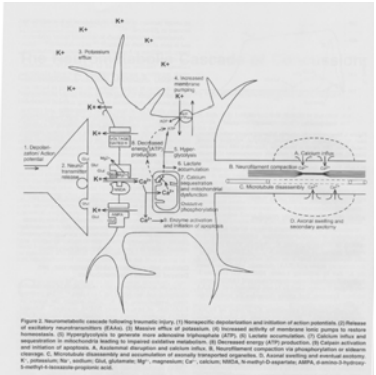
BAD

Neurometabolic Cascade

- Neuronal depolarization
- ↑ Glucose metabolism
  - cellular energy crisis
- ↓ cerebral blood flow

UNGOOD

"Metabolically for the brain, a concussion is like running a marathon."
Bleiberg, J. MD

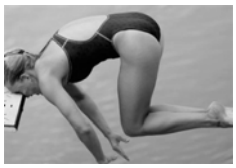


Pre-Season Preparation

- Baselines
- Prior History
- Communication
  - Athletes, Coaches, Parents, Teachers
- Equipment

Baselines

- SAC
- SCAT2
- BESS
- NP Testing



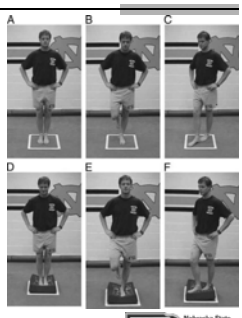
Tools

- SCAT2
  - http://www.sportconcussions.com/html/SCAT2.pdf
- BESS
  - http://www.nata.org/jat/readers/archives/39.2/i1062-6050-039-02-0156.pdf
- Zurich 2008 Consensus Statement
  - http://bjsm.bmj.com/cgi/content/full/43/Suppl_1/i76

Balance Error Scoring System (BESS)

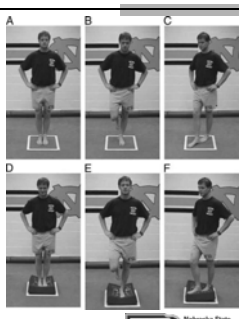
- 3 -20 sec. tests repeated on 2 surfaces; firm/foam
- Test Position
  - Hands on Hip, Head up, Eyes closed
- Trials
  1. Double-leg
  2. Single-leg (ND)
  3. Heel-toe tandem

  Rear-foot ND



Balance Error Scoring System (BESS)

- Errors:
  - Opened eyes
  - Stepped, fell, stumbled
  - Removed hands off hip
  - Moved hip 30º, flex/abd.
  - Lifted toes/heels
  - Remained out of position >5 sec.
- Errors tabulated for all 6 tests.



Neuropsychological Testing

- Involved Studies from Military, NCAA, NHL, eventually into NFL, IRL
- Testing includes:
  - History questionaire
  - Concussion Symptom Scale
  - Neurocognitive Measures
    - Memory, Working Memory, Attention, Reaction Time, Mental Speed, Processing, Visual Memory
- Clinical Report

Neuropsychological Testing

- Can see difference in age with regard to recovery
  - Approximately 25% of 18 yo or less many not return to baseline until after four weeks post-concussion;
  - Professional athletes seem to recover more rapid post-concussion.

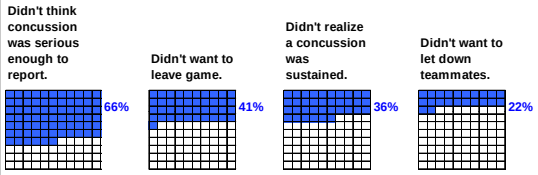
Prior History

- Important modifier
  - Number
  - Severity
  - Duration

Communication

- Not reasonable to assume all those involved are aware of affects of concussion
- "You can lead to the water …"

Clinical Journal of Sports Medicine, 2004. Concussion study of 1,532 high school football players in Wisconsin revealed that 47% of players who sustained a concussion continued to play without reporting the injuries to anyone. They listed their primary reasons:



Equipment

- Proper Fit
- Proper Maintenance
- Regular & Frequent Inspections
- New Developments

Riddell Revolution Helmet

- Concussion Rate
  - 5.3% *vs*. 7.6%
- *Absolute Risk*
  - reduction by 2.31%
- *Relative Risk*
  - reduction by 31%
- Had no affect on severity.

Evaluation

- Symptom – somatic, cognitive, emotional
- Physical signs – LOC, Amnesia
- Behavioral – irritability
- Cognitive Impairment - ↓reaction time
- Sleep disturbance – drowsiness

Evaluation – sideline

- ABC's – C-spine
- Remove from play
- Assessment – SCAT2/similar tools
- Serial Monitoring
- No RTP same day*
  - *athletes <19 yo
- Medical referral

Guskiewicz, KM, Bruce, SL, Cantu, RC, Ferrara, MS, Kelly, JP, McCrea, M, Putukian, M, Valovich-McLeod, TC. National Athletic Trainers' Association Position Statement: Management of Sports-Related Concussion. J Athletic Training, 2004; 39(3):280-297.

Post-Concussion Signs & Symptoms (PCSS) Checklist

	At time of injury
Blurred Vision	
Dizziness	
Drowsiness	
Excessive sleep	
Easily distracted	
Fatigue	
Feel "in a fog"	
Feel "slowed down"	
Headache	
Inappropriate emotions	
Irritability	
Loss of Consciousness (LOC)	
Loss of orientation	
Memory problems	
Nausea	
Nervousness	
Personality change	
Poor balance/coordination	
Poor concentration	
Ringing in ears	
Sadness	
Seeing stars	
Sensitivity to light	
Sensitivity to noise	
Sleep disturbance	
Vacant stare/Glassy eyed	
Vomiting	

Scale: 0 to 6
0 = not present
1 = mild
3 = moderate
6 = most severe

NOTE: the checklist should be used not only for the initial evaluation but for each subsequent follow-up assessment [2-3 hrs., 24 hrs., 48 hrs., 72 hrs.] until all signs and symptoms have cleared at rest and during physical exertion. In lieu of simply ch

Post-Concussion Signs & Symptoms Checklist

(Graded Symptom Scale)

Evaluation – ER/MD

- Comprehensive HX, neuro-exam
- ↑↓ S/S
- Neuro-Imaging?
  - CT Scans & standard MRI Scans
  - instruments that study structure and not function, therefore insensitive to subtleties of injury.
  - fMRI

Concussion Modifiers

Factors
- Symptoms
- Signs
- Sequelae
- Temporal
- Threshold
- Age
- Co- and pre-morbidities
- Medication
- Behavior
- Sport

Modifier
- Number
- Duration (>10 days)
- Severity
- Prolonged loss of consciousness (.1 min), amnesia
- Concussive convulsions
- Frequency—repeated concussions over time
- Timing—injuries close together in time
- "Recency"—recent concussion or traumatic brain injury
- Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
- Child and adolescent (<18 years old)
- Migraine, depression or other mental health disorders, ADHD, LD, sleep disorders
- Psychoactive drugs, anticoagulants
- Dangerous style of play
- High risk activity, contact and collision sport, high sporting level

Assisted Assessments

- Clinical Balance Assessment
  - BESS
- Neuro-Psych-NP
  - ImPACT, ANAM, CogSport, Head Minder
- Genetic Testing
  - Predisposed?
- Experimental Modalities
  - Biochemical markers
  - Electrophysiological

Return To Play

- Rest – S/S resolved
- Graduated RTP
  1) No Activity; Complete Rest (exertional & cognitive) until asymptomatic
  2) Light exertional activity; no resistance trng.
  3) Sport/position specific drills, light resistance trng.
  4) Non-contact drills, no scrimmage activity
  5) Resume full-contact drills in practice setting, ***with physician's authorization***
  6) Unrestricted game/competitive activity

Return To Play

- Same Day RTP
  - Adult athletes
  - <19 yr. – no RTP same day
- Psych/Mental Health
  - Depression, ADHD
  - Pharmacological
    - Mgt. of prolonged symptoms
    - Drug Tx modification of underlying conditions
      - RTP = Ø meds

Symptoms vs. Cognitive Function

- Symptoms often return to normal before Neurocognitive functions.

Return To Play

- Use Pre-Participation Evaluation
  - History
  - Baselines

Return To Play

- Effects of concussion:
  - Short-Term: post-concussion syndrome, second impact syndrome
  - Long-Term: changes of decision making and planning, headaches, memory changes, behavioral changes, depression

Second Impact Syndrome

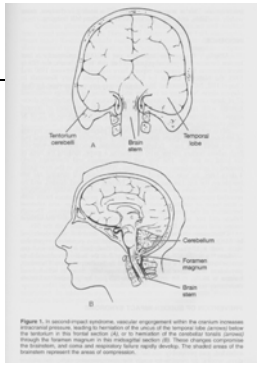
- A condition where an athlete remains symptomatic from previous concussion(s), who returns to play and sustains additional trauma to the head or central nervous system, usually within minutes after appearing to be "dinged". They collapse, become semi-comatose, pupils rapidly dilate, eye movement is lost, with respiratory failure not far away. Such a condition can elicit loss of the brain's vascular autoregulation. This leads to vascular engorgement and increased intracranial pressure.

Second Impact Syndrome

The increased pressure causes the brain to herniate and compromise ocular and respiratory function.

Second Impact Syndrome

- This catastrophic demise is very rapid and carries a 50% mortality rate along with almost a 100% morbidity rate.



Post-Concussion Syndrome

- Decreased Processing Speed
- Short-term memory impairment
- Concentration deficit
- Irritability, Depression
- Fatigue, Sleep disturbance
- Academic difficulties
- Headaches, Vision changes, Nausea

Special Considerations

- Child/adolescent athletes
- Elite vs. Non-Elite
- Chronic Traumatic Brain Injury (CTBI)

Prevention

- Proper Equipment & Conditioning
- Rule Changes
- Risk Compensation
- Aggression vs. Violence – fair play
- Education - Knowledge Transfer

Nebraska High Schools, Catastrophic Head Injuries

- *Brent Cerny, Cedar Bluffs HS*, FB 1995
  - Second-Impact Syndrome
- *Adrian Regier, Wheatland-Madrid HS*, FB 1997
  - Second-Impact Syndrome
- *Nick Vorhees, Harvard HS*, FB 1998
  - Subdural hematoma, decompression
- *Matt Hetrick, Coleridge HS*, FB 2004
  - Subdural hematoma, hospitalized only
- *David Huebner, North Platte*, FB 2004
  - Subdural hematoma, decompression
- *Brady Beran, Lincoln East*, FB 2004
  - Subdural hematoma, decompression
- *Eric Lofton, Om. Northwest*, FB, 2007
  - Subdural hematoma, decompression
- Derek Ruth (12yo) Malcolm MS, FB 2008
  - Subdural hematoma, decompression

Resources

- CDC – Tool Kit on Concussions for Coaches, Athletes, Parents.
  - *TBI - Coaches Tool Kit.mht*
- NATA & Riddell: Heads UP: Reducing the Risk of Head & Neck Injuries in Football.
  - *http://www.nata.org/consumer/headsup.htm*
- NY Times: High Schools Hidden Danger
  - *http://www.nytimes.com/2007/09/15/sports/football/15concussions.html?ex=1190692800&en=ea9ea26fa8668129&ei=5070&emc=eta1*
- ESPN – Outside the Lines: High School Concussions
  - http://sports.espn.go.com/broadband/video/videopage?videoId=309263&categoryId=2378529&n8pe6c=2

Q's & A?

THANK YOU

Mac McCuistion, ATC
(402) 560-2806
mmccuis@lps.org