

Sports-Related Concussion

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Conflict of Interest Disclosures for Aisha Joyce

	Off-label use of pharmaceutical agents
	Financial relationships with pharmaceutical companies
	Financial relationships with medical device companies
	Financial relationships with medical research organizations
	Financial relationships with medical education organizations
	Financial relationships with medical writing organizations

I will be (briefly) discussing off-label use of pharmaceutical agents.

Objectives

- At the conclusion of this activity, participants will:
 - Be familiar with concussion epidemiology
 - Understand the risks of sports concussion for young athletes
 - Be familiar with current sports concussion management guidelines
 - Be aware of strategies for concussion prevention and education



What is a concussion?

Definition

- International Symposium on Concussion in Sport, 2001 / 2004 / 2012

"a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces"

- Features
 1. Direct blow OR transmitted force
 2. Rapid-onset of relatively short-lived symptoms that resolve spontaneously
 3. Functional, not structural disturbance
 4. Symptoms generally proceed to resolution
 5. Standard neuroimaging is normal

Concussion Classification

- American Academy of Neurology
- Colorado Society/Boulder
- Cantu
- Simple vs. Complex

Concussion vs. mTBI

- Mild traumatic brain injury (mTBI) often used synonymously with term concussion
- Zurich, 2008
 - "different injury constructs"
 - "should not be used interchangeably"
 - "felt that the panel would not define mTBI for the purpose of this document"
- Zurich, 2012
 - "concussion is a subset of TBI"

Why do we worry about concussions?

The New York Times

Suicide Reveals Signs of a Disease Seen in N.F.L.

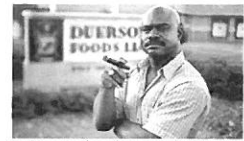


Former Bengal Henry Found to Have Had Brain Damage

Fern Alvarez

Los Angeles Times

Dave Duerson's suicide could be a turning point for NFL



Dave Duerson was a former Chicago Bears and New York Giants safety who grew up in Chicago. (Charles Cherny / Chicago Tribune)

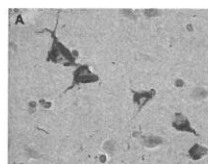
Chronic Traumatic Encephalopathy

- "punch drunk" syndrome in retired boxers, 1928
- "dementia pugilistica" introduced, 1937
- "chronic traumatic encephalopathy" coined, 1966
 - incidence and prevalence unclear
 - 68 autopsy-verified cases, 2013: 94% athletes, 78% football players, 13% boxers (McKee et al. *Brain* 2013)

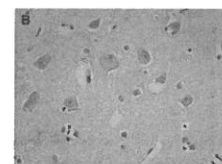


Chronic Traumatic Encephalopathy

- neurodegenerative disease
 - behavioral / mood / cognitive changes
- microscopic neuropathology
 - tau – intracellular neurofibrillary tangles, neuritic threads, glial tangles



NFL PLAYER



NORMAL CONTROL

NFL Data

- Retired NFL players with history of concussion
 - Association between recurrent concussions and increased depression risk
 - Former players with 3+ concussions have increased risk cognitive impairment
 - Guskiewicz et al *MSSE*, 2007
 - Guskiewicz et al *Neurosurg*, 2005



NCAA Data

- Prospective study of 2,900 football players
 - Players with h/o 3+ concussion more likely to have subsequent concussions
 - 92% of repeat concussions occurred in the first 10 days
 - Slower recovery with history of previous concussions
 - Guskiewicz et al, *JAMA*, 2003



Epidemiology

- participation in organized sports / year in the US
 - 44 million children & adolescents
 - 170 million adults
- incidence
 - 1.6 – 3.8 million athletes / year
 - 10 times more common than moderate & severe TBI³
 - average annual increase of 7% from 1988 – 2003 according to NCAA data

Epidemiology

- risk of concussion generally higher in competition vs practice
- frequency by sport
 - football > ♀ soccer > ♂ soccer > ♀ basketball
- ♀ vs ♂
 - higher rates within a given sport
 - higher rates within comparable sports
 - likely secondary to biomechanical, cultural, and physiologic differences

Concussion in Young Athletes



- High school athletes take longer to recover from concussion as compared to college athletes
 - Sim et al, *J Neurosurg*, 2008
 - Field, Collins and Lovell, *J Pediatrics*, 2003
- High School athletes with h/o multiple concussions have more severe symptoms with subsequent injuries
 - Collins, *Neurosurg*, 2002

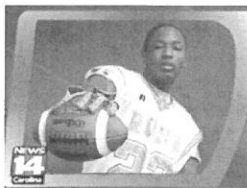
Concussion in Young Athletes

- Symptoms tend to be underreported
- Confidential survey of 1,500 high school football players
 - 30% reported history of prior concussion symptoms
 - 15% incidence during season studied
 - Fewer than half reported symptoms
 - McCrea, *Clin J Sports Med*, 2004



Second Impact Syndrome

- Concussive injury following incomplete recovery from a prior head injury
- Occurs in the **absence of hematoma**
- Results in catastrophic injury or death
- (Almost) exclusively in young athletes



Jaquan Waller, died of second impact syndrome in 2008, in North Carolina

Concussion Management

On-field Management

- aka Emergency Action Plan
- Recognition
- Assessment
 - Physical Exam, Sx, Behavior (ongoing)
- Disposition
 - Determine the need for ER evaluation
- Follow-up



Team Approach

- Primary Care Providers
- Sports Medicine Physicians/Team Physicians
- Certified Athletic Trainers
- School Nurses
- Neurology
- Neuropsychology
- Physical Therapy

Athletic Trainers

- American Academy of Neurology recommends an ATC be present for contact sport practices and games
- Not personal trainers
- Trained to recognize signs of concussion on the field
- Currently in 40% of high schools in the US



Office Management

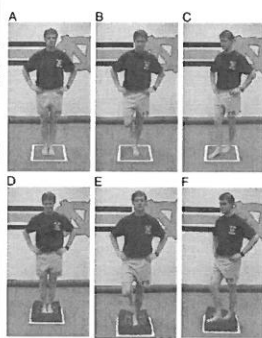
- History:
 - Mechanism of injury
 - Signs/symptoms at the time of injury
 - Sports played
 - Prior concussions
 - Current signs/symptoms
- Symptom score



How do you feel?
You should score yourself on the following symptoms, based on how you feel now.

	None	1	2	3	4	5	6
Headache	0	1	2	3	4	5	6
"Pressure" in head	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

Physical Exam









- Complete neuro exam
 - Gait, heel/toe/tandem
 - CNs, Romberg, finger-to-nose, rapid alternating movements
 - Strength, Reflexes
 - Occulomotor testing
 - Balance testing
 - BESS

Guskiewicz, J Athl Training, 2001


Balance Assessment – BESS

- practical for clinical sideline assessment
 - stopwatch
 - medium-density foam
- 6 trials
 - 3 stances
 - 2 surfaces
- BESS score
 - higher score = poorer performance

Physical Exam

- Cognitive Assessment
 - Orientation
 - Memory
 - Object recall-immediate/delayed
 - Injury mechanism/circumstances
 - Concentration
 - Serial 7's/3's, months backwards, "world" backwards, digits



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Neuropsychological Testing

- ImPACT
- Cogstate/Axon Sport
- Headminders
- Vital Signs
- [ANAM (Automated Neuropsychological Assessment Metrics—Army)]



ImPACT

- Computerized neuropsychological battery
- 20 minutes
- 4 parameters
 - Verbal memory
 - Visual memory
 - Reaction time
 - Processing speed
- Impulse control measure
- Most helpful if baseline prior to injury
- Normative data for children as young as 11 y

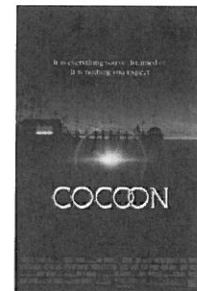


Additional Assessment

- Consider Neuroimaging
 - rule out other conditions
- Consultations
 - Neurology
 - Psychology/Psychiatry
- Formal neuropsychology testing
 - ImPACT is not a substitute

Treatment

- Physical rest
- Cognitive rest
 - “cocoon” therapy?
 - Limit screen time
 - Notes for school
- Average recovery is 10 days for high school students
- Consider longer rest period for elementary school athletes



Treatment: Medications

- sleep disturbance
 - melatonin, trazodone
- somatic (headache)
 - amitriptyline
- emotional (depression)
 - sertraline, citalopram, fluoxetine
- cognitive
 - methylphenidate, amantadine

Return to Play

- Once asymptomatic/at symptom baseline
- Consider ImPACT testing
 - Especially if baseline available
- Graded progression
 - Progress to next step only if asymptomatic

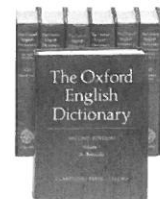
Return to Play

- Graded progression
 - Light aerobic activity
 - Light sport-specific drills
 - Complex sport-specific drills
 - Full contact practice
 - No restrictions



Post-Concussive Syndrome

- Poorly-defined term
- No definition in Zurich
- No agreement
 - ICD-10
 - DSM
 - Scientific Literature/Expert Opinion



Post-Concussive Syndrome

- Athletes with symptoms attributable to concussion should not be allowed to return to activities with contact risk
- Return to aerobic exercise may be appropriate 6 weeks after injury
 - Consider exercise at sub-symptom threshold

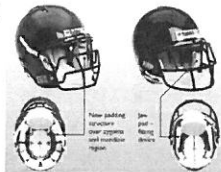
- Reddy et al, Clin J Sp Med, 2010

Deciding to Hold Clearance

- Prolonged symptoms
- Associated mental health concerns
- Any persistent exam findings
- Multiple concussions
 - Frequent
 - Increasing severity
 - Decreased force of impact required

Prevention: Helmets

- Prevent skin lacerations, skull fractures
- Some studies suggest they may increase risk of concussions
 - Increase mass of head & rotational force / torque



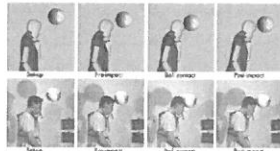
Soccer and Heading

- No good evidence that heading has long term cognitive effects
- Headgear does not reduce impact/injury with heading
 - May reduce injury severity with head-to-head or head-to-post contact



- Withnall, BJSM, 2005

- Recommendations/Conclusions
 - No heading before age 10
 - Athletes should be taught good technique
 - Concussion education important for all soccer players
 - Heading does not cause concussions
 - Appropriate size ball



Shewchenko, BJSM, 2005

- No differences in ImPACT scores following concussion in athletes who used mouthguards vs. those that did not
 - Mikalik, 2007
- No difference in concussion rates with custom vs. non-custom mouthguards
 - Wisniewski, 2003
- No difference in concussion rates in basketball players who used mouthguards vs. non-users
 - LaBella, 2002

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- Widely held misconceptions about concussions among youth sport coaches
 - Valovich, 2007, Cusimano, 2009
- Underreporting of concussion symptoms by athletes
 - McCrea, 2004
- CDC materials: Heads Up!
 - Cdc.gov/concussion
 - Preventingconcussions.org

- Washington State
 - First to introduce concussion legislation
- Zackery Lystedt law
 - Suffered a concussion and returned to play as a middle school football player
 - Collapsed following return
 - Devastating neurologic injury

Legal

- State of Virginia – Senate Bill Virginia Board 652 adopted 1/2011
 - Any athlete with signs of a concussion should be removed from activity until cleared by an appropriate health care professional
 - School boards develop guidelines and educational materials on concussion for athletes, parents, coaches
 - Schools should have athletes/parents sign an information sheet
 - An athlete must provide written clearance from an appropriately trained licensed health care provider prior to return-to-play.

Conclusions

- Sports concussions are a concern for young athletes, parents, coaches and health providers
- Concussion management requires familiarity with latest guidelines and management tools
- New legislation on concussion will likely lead to more athletes presenting to the pediatricians office with concussions

Thank you!