

SPORTS RELATED CONCUSSIONS EVALUATION, MANAGEMENT, AND WHEN TO RETURN TO PLAY



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Heading Towards the Goals

What kind of signs or symptoms would make you *suspect* a concussion?

What are the risks, both short and long-term, for one or more concussions?

What tools can medical providers utilize to help diagnose and follow a potential concussion?

What are appropriate initial management responses to a concussion?

How can we best adhere to recent guidelines for concussion management?

How can we best educate our patients and families about sports-related concussions?

Case One: Defining the Problem

16 y/o soccer player hit heads with another player yesterday. Comes in for evaluation as athletic trainer felt she was acting differently and complaining of headache after the injury.

Parents don't believe she has a concussion since she wasn't knocked out, her pupils seemed even, and she really wants to return to soccer and other activities.

How do you define/explain a concussion to this family?

Does she have a concussion?

WHAT IS A CONCUSSION?
AKA: dinged, knocked out, bell rung, saw stars...





Pathophysiological process due to biomechanical forces leading to alterations in cognition, personality, affect, mental status, and/or general behavior



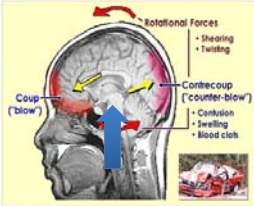
WHAT IS A CONCUSSION?
Sport-Related vs. MVA/High Impact Concussions

- May not involve direct head trauma
 - Whiplash
 - Rotation or deceleration injury
- Loss of Consciousness NOT required
- Glasgow Coma Scale usually 15
- May actually walk (or stumble) into the office/clinic for evaluation





Mechanisms of Injury

- Coup
 - Direct or primary impact
- Contrecoup
 - Indirect or secondary impact
- Rotational Force
- New research focusing on cumulative burden of sub-concussive head impacts



Traction to mid-brain/brainstem



AT THE CELLULAR LEVEL

Giza CC and Novits DA, The Neurochemical Cascade of Concussion, J Ath Train, 2001 Jul-Sept, 36(3): 228-235

- Neuronal shearing
- Indiscriminant release of neurotransmitters and unchecked ion fluxes
- Initial disparity between increased glucose demand and decreased supply leads to early vulnerable energy crisis
- Followed by reduced glucose demand and depressed metabolism

Copyright by the National Athletic Trainers Association, Inc

The Clinical Concerns

© 2008 Concussion Management Systems, Inc. All rights reserved. For more information, visit us online at www.concussion.com. These charts are intended for educational purposes only. They are not intended for clinical use.

Is loss of consciousness required for the diagnosis of sport concussion?

NO!

Less than 15% involve LOC

Some Particular Pediatric Symptoms

On-Field Signs that May Identify Potential Concussion

- Perseveration
 - Repeating same comment
- Emotional Lability
 - Inappropriate laughing or crying
- Athlete staying on the “periphery”
 - Not as engaged or aggressive
 - Avoiding eye contact
- Dazed or confused
- Perseveration
 - Repeating same comment



Case Two: What's the Big Deal?

17 y/o football player comes in for pre-participation physical exam.

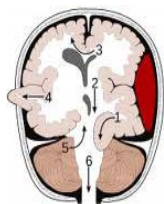
After the exam, dad wants to know why “all the recent fuss” over concussion in kids? When he played high school football, guys got “dinged” all the time, and as long as they could figure out what team they were on and somewhat remembered the plays, they were allowed back to play.

Why is there is so much concern in the medical and even legislative communities?

Unique Child and Adolescent Vulnerability

- **Increased risk of autonomic dysregulation can lead to cerebral edema, brainstem herniation and death**

- Controversial if due to “Second Impact Syndrome”
- Controversial if heightened efforts prevent head-injury related deaths



The More Common Vulnerability





- **Adverse School Performance**
 - Sequential subjects (math or foreign language) most affected
 - Poor testing
 - Partial/Full absences
- **Impact on personality**
 - Disruption of Environment and Identity
 - Social isolation
 - Depression and ? early-onset dementia
- **Overloading the healing brain**
 - Catching-up on missed work
 - Keeping up with regular work
 - Sport-based stresses




Concussed Children- Particular Concerns?


- Young children may require increased force when compared with adults to become symptomatic after head injury
- Once actual injury occurs, the immature brain is likely to respond less well overall



Adolescent Vulnerability



- Experience and preliminary neurocognitive data may suggest a more protracted recovery in high school vs. college athletes (Field, 2003)
- Females might have prolonged recovery compared with age-matched males



Association of Interpersonal Violence with Self-Reported History of Head Injury
Pediatrics 2011; 127-6, pp1074-1079



- Study participants who had ever experienced a head injury before young adulthood reported more interpersonal violence in young adulthood
- Findings more prevalent in the first year after a head injury



Association of Head Injuries and Dementia in Later Life

Presented at Alzheimer's Association International Conference, July 2011

- 280,000 military veterans over age 54
 - Those with diagnosis involving traumatic brain injury faced triple risk for developing dementia
- 500 former NFL players who were showing signs of mild cognitive impairment
 - Had similar cognitive function as elderly people several years older



C.S. Mott Children's Hospital-National Poll on Children's Health

Vol. 10 Issue 1 ■ June 14, 2010

- Among parents whose children 12 to 17 years old play school sports:
- Only 8% have read or heard a lot about the risks of repeat concussions in school sports.
- More than 50% do not know if their children's school has a policy about returning to sports after a concussion.
- 62% know of a parent who would have his or her child return to school sports too soon after a concussion.
- 84% strongly support a requirement that athletes be cleared by a doctor before returning to play after a concussion.



California Interscholastic Federation Bylaw 313

A student-athlete who is suspected of sustaining a concussion or head injury in a practice or game shall be removed from competition at that time for the remainder of the day.

A student-athlete who has been removed from play may not return to play until the athlete is evaluated by a licensed health care provider trained in the evaluation and management of concussion and **receives written clearance** to return to play from that health care provider.



California Assembly Bill 25- 2010 (Hayashi) in committee



- Requires any organization that uses school facilities or grounds for youth athletic activities to provide a statement of compliance with the policies for the management of concussion and head injury.
- Requires a school district that elects to offer athletic program to immediately remove from a school-sponsored athletic activity an athlete who is suspected of sustaining a concussion or head injury during the activity.
- Prohibits the return of the athlete until he is she is evaluated by a licensed health care provider, trained in the management of concussions, acting within the scope of his or her practice



NCAA Concussion Management Plan Requirements 2010

- Institutions shall have a concussion management **plan on file** such that a student-athlete who exhibits signs, symptoms or behaviors consistent with a concussion **shall be removed** from practice or competition and **evaluated** by an athletics healthcare provider with experience in the evaluation and management of concussion.
- Student-athletes diagnosed with a concussion **shall not return** to activity for the remainder of that day



Madden 2012- New Emphasis on Concussions

- This year's version of the Madden video game will place a new emphasis on concussions, with any player suffering a concussion being sidelined for the rest of the game, and the game announcers (Gus Johnson and Cris Collinsworth) explaining the seriousness of head injuries.



Case Three: Called to the Scene

You are at your son's Little League game
 Catcher takes a hard foul ball off the facemask
 He has new-onset headache, dizziness, and loud voices are bothering him
 He's the only catcher on the team and is eager to return
 You are asked- can he go back in?

The Child and Adolescent Athlete: Same Day Return-to-Play

Summary and Agreement Statement of the 3rd International Conference on Concussion in Sport, Zurich 2008

It is not appropriate for a child or adolescent athlete with concussion to RTP on the same day as the injury, regardless of the level of athletic performance.

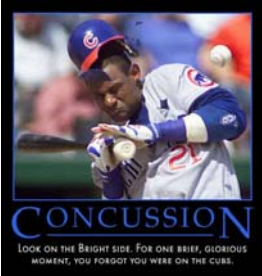


Case Four- A Dropped Cheerleader

- 14 y/o flyer lands on upper back after being dropped during stunt practice
- Urgent Care next day, diagnosed with neck sprain
 - Naprosyn, soft collar, no sports for 10 days
- Seen 5 days afterward reporting neck and upper back tightness
 - Initially mother and patient denied any concussion
 - Upon further questioning- headache, poor concentration and found friends and bright lights "irritating"

WORKING BACKWARDS
Less Obvious Concussion Presentations

- Facial or nasal trauma
- Mood changes
- Change in grades/sport/work performance
- Increased sleep
- Persisting headache
- Non-sport concussions count
- Athlete fearful of admitting the injury
- Athlete/Family uncertain about concussion



CONCUSSION
LOOK ON THE BRIGHT SIDE. FOR ONE BRIEF, GLORIOUS MOMENT, YOU FORGOT YOU WERE ON THE CUBS.


CAIOPediatrics

Case Five: High School Student Wants to Know his Grade

16 y/o soccer player hits head to head blow with an opponent yesterday. Now has headache, dizziness, poor balance amongst other symptoms. No loss of consciousness.



How would you grade this concussion?

Evidence-Based Concussion Grading and Classification Scales



Grading the Grading Scales

- Head injury grading scales should be **abandoned** in favor of combined measures of severity and prognosis
- Continued support for individually guided return to play decisions
- Concussion severity can only be ascertained retrospectively after **all signs and symptoms** have cleared
 - Length of symptoms more salient than initial intensity or number of symptoms



Trying to Predict Severity on Day 1




- Initial symptoms may actually worsen over first 24-48 hours
- New symptoms may present
- Behavior over first 48 hours can influence long-term course



“Routine” Concussion Recovery

Summary and Agreement Statement of the 2nd International Conference on Concussion in Sport, Zurich, 2008

- Rest, symptom resolution, graded return-to-play
- Limited intervention other than mental status and symptom monitoring
- Can be managed by primary care provider or certified athletic trainer working under medical supervision
- Progressive recovery within 7-10 days
- Recovery period may be longer in children and adolescents



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**Can I Play Tomorrow?
How long am I out?**

- Strongly advise against clearing athlete for return to play after initial evaluation
 - Involve Primary Provider or Team Medical Staff
 - Certified Athletic Trainer
- Strongly advise against **predicting** anticipated return to play date
- Educate family that each concussion is unique




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Case Six: The Ground Always Wins


17 y/o linebacker has headache and dizziness after head vs. ground impact last night. Removed from game. Went to ED and had unremarkable Head CT Scan. Parents left with the impression that normal CT means no concussion and no major problems.

Is this accurate?
How else can you evaluate this young man?

Initial Evaluation





- Depend on others
 - Parents
 - Teammates
 - Coaches
 - Athletic Trainers
- Impossible to appreciate subtle changes if you have never met the athlete





Initial Evaluation

- **Never underestimate the desire to return to the field**
- Take necessary time to make accurate evaluation
- Take away helmet




Diagnosing Concussion


- No "gold standard" test
 - History of injury
 - Social/PMH
 - Symptom Scales
 - Physical Exam
 - Balance testing
 - Neuro-cognitive Tests
 - Imaging
- Serial Exams and Clinical Judgment essential
- Baseline scores can assist



History of Acute Injury

- Mechanism/Location of Impact(s)
 - May be multiple sub concussive impacts
 - Intensity of impact may not correlate with long-term outcome
- Initial Response
 - Continued to play vs. removal






Complicating Factors





- Past concussions
- Underlying learning disability or mental health issues
- Type A overachievers
- Acute/Chronic sinus issues
- Alcohol, caffeine, or recreational drug abuse
- Past history of headaches
 - Especially Migraine
- **Family history of severe or multiple concussions**
- **Concurrent major life changes**
 - Divorce/Separation
 - Moves
 - Collegiate applications




SCAT2

http://bjsm.bmj.com/cgi/reprint/43/Suppl_1/1857maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=SCAT2&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourceType=HWGIT









SCAT2

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SYMPTOM SCALES
Age > 10 y/o

- GOOD
 - Objective Likert scale of otherwise subjective symptoms
 - May educate athlete and family on otherwise unacknowledged signs of concussion
 - Return to activity protocols predicated on **symptom resolution**
- BAD (OR UNKNOWN)
 - Best if have baseline, pre-injury scores
 - Is athlete/family being honest?
 - High school athletes neurocognitive deficits persisted even after symptom reports returned to baseline

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Which On-Field Signs/Symptoms Protracted Recovery From Sport-Related Concussions Among High School Football Players?
AJSM 2011 Jun 28 (Epub ahead of print)

- Dizziness at the time of injury was associated with a 6.34 odds ratio of a prolonged (>21 days) recovery from concussion



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FOGGINESS OR "FEELING IN A FOG"

- Lower scores on measures of memory functioning, processing speed, and reaction time
- "most significant (symptom) in determining how rapidly one will recover from a concussion" (Lee, 2010)



HOW ABOUT HEADACHE?

- Most commonly reported symptom (80-90% of concussions)
- Baseline headache common amongst football players
- Concerning signs
 - Different location or intensity
 - "Throbbing" signals onset of worsening of symptoms and relative over activity
 - Worsening headache
- Any degree of headache in high school athletes 7 days after injury is likely associated with incomplete neurocognitive recovery (Collins, 2003)




LOSS OF CONSCIOUSNESS


- Uncertain predictive role in determining length or severity of concussion (McCrea, 2002; Lovell, 1999)
- Presence of LOC > 1 minute would be considered a factor that may modify management (McCrory, 2009)



CONVULSION/SEIZURE


- Although dramatic, these clinical features are generally benign and require no specific management beyond the standard treatment of the underlying concussive injury (McCrorry, 2009)






NEUROLOGIC TESTING

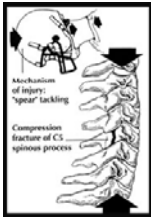
- Speech and facial affect
 - Blunted facies
 - Speech perseveration
- Lightheadedness with rapid eye or head motion
- Nyctagmus with abrupt cessation of rapid eye movement
- Altered eye convergence






Cervical Spine Issues


- Loss of normal cervical lordosis
 - "Spear-tacklers spine"
 - May have limited cervical range-of-motion
 - Absolute contra-indication to contact/collision sports
- Cranial-cervical muscle spasm, cervical sprain and facet issues can worsen headache






BALANCE AND POSTURAL STABILITY

Guskiewicz, Clin J Sports Med 11:182, 2001




- Concussion can lead to acute balance deficits
 - Ineffective use of vestibular and visual cues
 - Romberg test often not sensitive enough
- Developed **Balance Error Scoring System**
 - Double leg, single leg and tandem balance on both firm and foam surfaces
 - Baseline compared with post-injury results
- "Practical, valid, and cost-effective method of objectively assessing postural stability"




NEUROCOGNITIVE TESTING

Standardized Assessment of Concussion (McCrea, 01)


- Brief (~ 5 min) screening instrument
 - Measures of Orientation
 - Immediate memory
 - Concentration
 - Delayed recall
- **Neurocognitive recovery may occur after symptom resolution**






Standardized Assessment of Concussion (McCrea, 01)

http://www.camisolutions.com/cmit/uploads/sac_informational_kit_001.pdf





- Can be integrated in ED evaluation
 - Give copy to family for f/u
- Ancillary staff can administer, inexpensive, portable, pencil and paper test
- How to interpret results
 - Drop of 1 or more points from baseline
 - School level standard if no baseline
 - Jr. High 25/30 or higher
 - High school 26/30 or higher
 - Collegiate 27/30 or higher
 - + (Randolph, 2001)





NEUROCOGNITIVE TESTING
Computerized Platforms

- Premises:
 - Cognitive deficits may be present after symptoms resolution
 - Patients may lie or minimize symptoms
 - Objective evaluation of cognitive function:
- Neurocognitive deficits have shown correlation with cerebral blood flow abnormalities
- Professional, collegiate and some high school use



COMPUTERIZED NEUROCOGNITIVE TESTING
The Mechanics

- Evaluates processing speed, reaction time, attention, concentration, memory and verbal function
- Best if have individualized baseline for comparison
- Need to have quiet environment
- Testing can take up to 25-30 minutes



NEUROCOGNITIVE TESTING
Computerized Platforms- Points of Contention

- Cost
 - Baseline and follow-up testing
- When to re-test?
 - Starting within few days after concussion
 - Test only after symptom-free
- Who will interpret?
 - Evaluate baseline tests
 - Not a clear-cut RTP decision
 - Training and potential liability?
 - Requires neuropsychiatric support?
- Is the testing valid?




COMPUTERIZED NEUROCOGNITIVE TESTING
Summary Thoughts


- **Not** a stand-alone or gold standard tool for determining return-to-play
- Can help families accept diagnosis of concussion
- Needs a comprehensive team to utilize and evaluate
- **Clinical judgment is still essential**



IMAGING


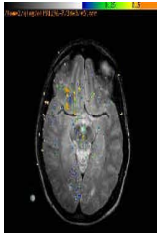


- Limited evidence-based indications for Brain CT/MRI
 - Prolonged disturbance of consciousness
 - Focal neurologic deficit
 - Worsening symptoms
 - >10 days of symptoms
 - Parental/provider concern
- Conventional neuroimaging usually normal



FUNCTIONAL MRI?
(Lovell, *Neurosurgery*, 2007)

- Initial frontal hyperactivation= longer recovery time
- Close relationship between cerebral blood flow and computerized neuropsychological testing



DISCUSSING IMAGING RESULTS

- **How** results of imaging presented to athlete and family is **key** to acceptance and understanding of sport-related concussion
- Normal neuroimaging doesn't mean patient is OK or doesn't have a concussion



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Case Seven: I've Got a Concussion and I'm Going to Disneyland!

14 y/o gymnast hits head vs. beam during a fall. Next day, seen in office with symptoms, balance and memory/focus issues.

Parents acknowledge she shouldn't return to sport, but since "nothing" can be done to "cure a concussion", they ask if she can keep up busy schedule including honors courses, school dance and trip to Disneyland.

Is there a better recommendation?

Talking Points

- Emphasize immediate rest ultimately may lead to:
 - Less time away from sport
 - Less school-issues
 - Less risk of recurrence
- Don't underestimate risk of recurrent/complex concussions
 - Post-concussive syndrome
 - Risk of depression
 - Risk of permanent cognitive changes
 - ? Risk for Alzheimer Disease



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PRE-EXISTING CONDITIONS WILL OFTEN WORSEN

- Headaches- namely migraine
- ADD/ADHD
- Depression
- Sleep issues



2011 CONCUSSION QUOTE OF THE YEAR

“School is the enemy of concussions”

-Michael Lee, MD



Working with Schools

- Develop relationship
 - School Nurse
 - Counselors
 - Speech/Occupational Therapists
 - School District Protocols/Teams
- Flexibility-individualize plans
- Exempt some missed work
- Able to concentrate 20-30 minutes without symptoms-start return to school

RETURN TO SCHOOL MODIFICATIONS AFTER CONCUSSION

NAME _____ DATE OF INJURY _____

1. PLEASE ALLOW PARTIAL DAY ATTENDANCE EXCEPT MISSED DAYS
2. PLEASE ALLOW REST PERIODS AND FREQUENT BREAKS
3. PREFERENTIAL SEATING IN FRONT OF CLASSROOMS/BACKS FROM WINDOWS
4. PLEASE ASK TO SPACE OUT HOMEWORK ASSIGNMENTS
5. PLEASE ALLOW DELAYED/POSTPONING ASSIGNMENTS, PROJECTS AND TESTS
6. PLEASE ALLOW ASSIGNMENT WITH NOISY MACHINES
7. PLEASE ALLOW EXTRA TIME TO COMPLETE TESTS
8. PLEASE ALLOW TESTS TO BE INDIVIDUALLY TAKEN IN A QUIET ROOM WITH LIMITED DISTRACTIONS
9. PLEASE SCHEDULE BARRING ONE TEST PER DAY, PREFERABLY FIRST THING IN MORNING, DURING RECOVERY PERIOD
10. APPROPRIATE SUPPORT AND POSITIVE REINFORCEMENT ARE IN PLACE
11. PLEASE CONTACT ME WITH ANY QUESTIONS OR CONCERNS

SIGNATURE _____ DATE _____

MODIFICATIONS IN PLACE UNTIL _____

NEXT PHYSICIAN EVALUATION _____



Case Eight: Return Put on Ice?

17 y/o hockey player had concussion 2 weeks ago. No exertion since then. Initial symptoms, neurocognitive and balance deficits have resolved to your satisfaction 3 days ago.

Has big game against cross town rival tomorrow

Since asymptomatic, can he be cleared to suit up?

Returning to Play Acknowledging the Risks



STEP-WISE RETURN-TO-PLAY PROTOCOL California State University, Fullerton, 2010

1. LIGHT EXERTION (NON-CONTACT, NON-IMPACT) AWAY FROM TEAM
2. INCREASED NON-CONTACT AND NON-IMPACT INDIVIDUAL CONDITIONING AND LIGHT SPORT-SPECIFIC ACTIVITIES
3. NON-IMPACT AND NON-CONTACT DRILLS WITH TEAM
4. FULL IMPACT AND CONTACT PRACTICE ACTIVITIES WITH TEAM
5. RETURN TO FULL COMPETITION

GENERALLY, A 24 HOUR PERIOD SHOULD TAKE PLACE BETWEEN EACH STEP. MODIFICATIONS OF THIS PROTOCOL MUST BE DISCUSSED WITH TEAM PHYSICIAN


- PRESENCE OF ANY SYMPTOMS OR PROBLEMS- STOP ACTIVITY
 - MAY RESUME AT SAME OR LOWER LEVEL AFTER NO LESS THAN ONE DAY OF REST
- PRESENCE OF SYMPTOMS WITH 2 CONSECUTIVE EXERCISE SESSIONS INDICATES NEED FOR RE-EVALUATION BY PHYSICIAN



Return to Play? Initial Activity




- Must be supervised by health care professional or non-coaching adult
- Eliminate extra stressors
 - Focus on school, sport, nutrition and sleep
- Evaluate pre/post activity symptoms
- Weight-training?
 - Light weight, high reps
 - No overhead, valsalva, maximum exertions
 - May delay until full on-field return



Heading Back into the Game

- Check equipment for proper fit
- Anticipate Fatigue
 - Shorter shifts, need for substitution
 - Football- don't recommend playing "both ways" initially
- Soccer
 - Introduce heading late in recovery
- Hockey/Lacrosse
 - Introduce checking late in recovery



Case Nine: Repeat Offender



17 y/o female wants clearance to play lacrosse and soccer. Has a history of 3 known, documented concussions.

What factors must you consider in making this clearance decision?

Would you clear this athlete for those sports?



When it is Too Many?

- Ascertain risk tolerance of athlete and family
 - One might be enough
- Overall number and number in particular season
 - Second in season- more conservative?
- Literature
 - No absolute "high number"



Factors to Consider

- Review each episode
 - Nature/intensity of impact
 - Number and length of symptoms
 - Less impact or progressive longer recovery- not favorable
 - Interval between episodes
- Academic performance
- Sport and position
- Family and social history
- Future Goals

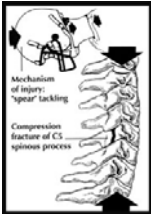
Role for Genetics?

- Published studies suggest Apolipoprotein E4 gene is a risk factor for adverse outcomes
 - 12 times increased risk for traumatic encephalopathy in boxers
 - True significance is uncertain
 - Routine genetic screening cannot be recommended at this time
- Role?
 - Family history of multiple members with complicated concussions





Don't Forget the Neck...

- Spear-tacklers Spine
 - Decreased cervical lordosis
 - Imaging reveals limited cerebral-spinal fluid cushion around cervical spine
- Increased risk of catastrophic neck injury and concussion
- Absolute contra-indication to contact/collision sports
- *Prevention: Always be able to see the person you are tackling!*



Mechanism of injury: "spear" tackling
Compression fracture of C5 spinous process



Who is at particular risk?




- Contact or collision sports at highest risk
 - Extreme sports
 - Cheerleading
 - Football
 - Quarterback, linebacker, receiver, defensive back
 - *Leading with the head*
 - Hockey
 - Wrestling
 - Basketball
 - Soccer
- "Off-field" or outside of sport concussions still matter



EPIDIMIOLOGY OF HEAD INJURIES


NCAA DATA (1984-1991)

SPORT	HEAD INJURIES PER 1000 ATHLETE-EXPOSURES	CONCUSSIONS PER 1000 ATHLETE-EXPOSURES
MEN'S SOCCER	0.31	0.25
WOMEN'S SOCCER	0.29	0.24
FOOTBALL	0.29	0.27
ICE HOCKEY	0.30	0.25
FIELD HOCKEY	0.23	0.20
WRESTLING	0.28	0.20



What about Soccer?


- Concussions more common in soccer than previously thought
- All head injuries in the NCAA and other studies were due to collision with
 - another player
 - the ball
 - the ground
 - goalpost



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What about Soccer?

PEDIATRICS 2010; Vol. 125 No. 2, pp. 410-414



- Data are insufficient to link repetitive heading with permanent cognitive impairment
- American Academy of Pediatrics encourages that heading of the ball only be taught when the child is willing to learn proper technique and has developed coordinated use of his or her head, neck, and trunk to properly contract the neck muscles and contact the ball with the forehead
- This guidance is based on consensus of opinion among members of the AAP Council on Sports Medicine and Fitness Executive Committee, because there is no valid evidence to support this conclusion

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Case Ten: Preventing Head Injuries?

After hearing all this discussion, you wonder...are there measures that can help prevent head injuries in the first place?

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Rule Enforcement




- No spearing or leading with head
- Officials penalizing violent play and removing repeat offenders
- Restrict direct blows to the head




Are Helmets the Answer?




- May reduce impact with direct linear force
- May also increase risky behavior
 - Adolescent Invulnerability or over-reliance on helmet
- Definite reduction in head injury with bicycle helmets
- Ski helmets- some evidence of risk reduction



Football and Soccer Helmets



- Football
 - No on-field evidence that a particular type/brand of helmet confers greater risk reduction
 - Proper fit and maintenance is important
- Soccer
 - No evidence that helmets reduce risk of concussion
 - May reduce risk of facial trauma



Dietary Supplementation with the Omega-3 Fatty Acid Docosahexaenoic Acid in Traumatic Brain Injury
Neurosurgery 2011 Feb; 68(2); 474-81





- Adult rats subjected to TBI after prior DHA supplementation
- Reduced injury response as measured by axonal injury counts, markers for cellular injury and apoptosis, and memory assessment by water maze testing
- The potential for DHA to provide prophylactic benefit to the brain against TBI appears promising and requires further investigation
- Role for actual treatment post TBI or with post-concussive syndrome uncertain and worthy of future research as well



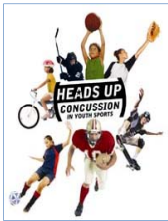

When to Refer

- Feeling pressure to return athlete
- Confusing or worsening presentation
- Prolonged or complicated symptoms
- Clearance with multiple concussions
- Help with school modifications


CDC Heads Up: Concussion in Youth Sports
<http://www.cdc.gov/ConcussionInYouthSports/>

- Fact sheet for coaches
- Fact sheet for athletes
- Fact sheet for parents
- Clipboard with concussion facts for coaches
- Magnet with concussion facts for coaches and parents
- Poster with concussion facts for coaches and sports administrators
- Quiz for coaches, athletes, and parents to test their concussion knowledge

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Our Present and Future Athletes Thank You!

