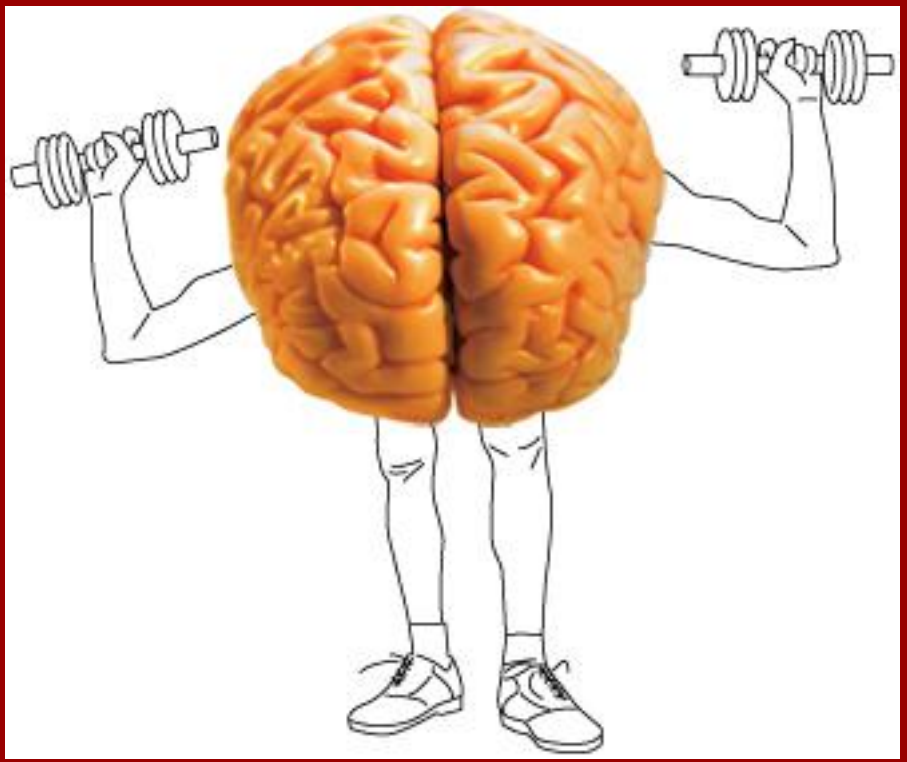
Concussion: What is it and What Do we Do About it?



Farah Hameed, MD
Department of Rehabilitation and Regenerative Medicine

The Sports Medicine Center for the Developing Athlete
Columbia University
New York Presbyterian Hospital

Who Am I?

- Undergraduate/Graduate Training:
  - University of Texas at Austin
  - University of Texas Medical Branch
- Residency Training:
  - Physical Medicine and Rehabilitation – board certified
  - Spaulding Rehabilitation Hospital/Harvard University
- Fellowship Training:
  - Sports Medicine – board certified
  - Rehabilitation Institute of Chicago/Northwestern University

Concussion- What is it?

- It is a *mild* **traumatic brain injury** affecting the brain induced by either direct or indirect forces to the head
- Concussion is largely a ***functional*** disturbance instead of a structural injury due to rotational and/or shearing forces on the brain.
- These forces cause stress on the brain tissue, vasculature and other neural elements
- It normally presents as a rapid onset of short-lived impairment of neurologic function that resolves spontaneously

Prevalence

- Between 2001-5, Bakhos et al reported that concussions in 8-19 year olds resulted in more than 500,000 ED visits ~ 50% due to a sports; 35% aged 8-13
- 53% of high school or college student athletes have reported + history of concussion
  - 36% of collegiate athletes have reported a history of multiple concussions
- CDC estimates that **1.6-3.8 million** sports related concussions happen each year in both children and adults

Common Features of a Concussion

- Sometimes can be difficult to identify*
- Symptoms occur *after* impulsive or direct forces on the head, face, neck or elsewhere (symptoms can occur up to 36 hours after injury)
- Usually short-lived neurological impairment, which typically resolves spontaneously (normally within the **7-10 days** after injury)
- Infrequent LOC (9-18%)
- Routine neuroimaging studies are typically normal.

Signs of a concussion

- Physical disturbances (vision changes, balance problems)
- Somatic symptoms (headache, nausea)
- Cognitive symptoms (feeling slowed down, in a fog)
- Emotional symptoms (emotional lability, mood changes).
- +/- Loss of consciousness
- Amnesia (antero-, retrograde)
- Behavioral changes (irritability)
- Cognitive impairment (slowed reaction times, inability to focus/learn)
- Sleep disturbances (too much, too little)

Management

- Criteria for hospital/emergency dept evaluation:
  - Worsening headache
  - Athlete is very drowsy or cannot be awakened
  - Inability to recognize people or places
  - Repeated emesis
  - Unusual or very irritable behavior
  - Seizures
  - Weakness
  - Unsteady gait

Clinical Examination

- Physical neurologic examination:
  - CN (*oculomotor system)
  - Strength
  - Reflexes
  - Sensation
  - Cerebellar testing (coordination)
- Balance testing
  - BESS testing
- Symptom scores
- +/- Neurocognitive testing

- Cognitive Assessment:
  - Mini mental
  - Orientation
  - Serial 7's, months backwards
  - Series of digits backwards
  - Immediate/recall memory
- Musculoskeletal exam
  - Cervical spine tenderness, ROM, posture, muscular imbalance

Who is at Risk?

- Like many injuries, the best predictor of subsequent injury is history of similar injury.
- Those who reported a history of 2 concussions were 2.8x more likely to sustain a concussion than players with no concussion history; those with a history of 3 or more previous concussions were 3.5 times more likely to sustain a concussion
  - This increased risk remained after adjusting for sports, body mass index, year in school.
- With history of + LOC, risk increased to 6 times more likely

Risk Factors

- Concussion history
- High risk sports
- Age
- Gender (2-2.5x with females)
- Neck strength
- Force/Location of impact
- Frequency/timing/fatigue
- Anticipation of collision

- Can be complicated by history of:
  - Migraines
  - Anxiety
  - Depression
  - ADHD
  - Learning disabilities
  - Cognitive delays
- Family History
  - Genetic studies

NO KNOWN THRESHOLD FOR CONCUSSIVE INJURY!

Management

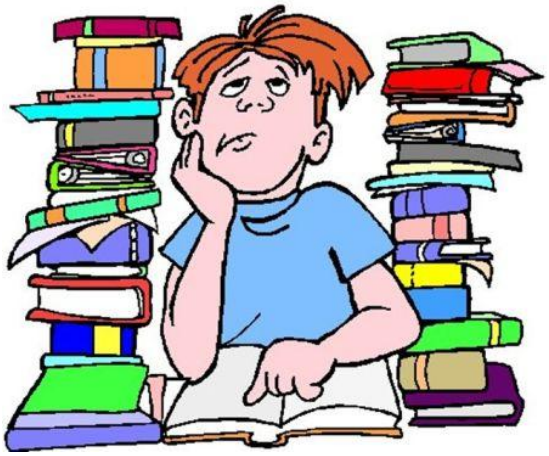
Cognitive Rest	Avoid text messaging/video games Limit television and computer use Decrease schoolwork	Avoid activities that require attention/concentration
Physical Rest	Avoid any physical activity that exacerbates symptoms (aerobic exercise, weights, chores)	Severe or worsening headache, persistent vomiting or seizures may suggest need for emergent evaluation

** Education on what to expect is likely one of the most important things to discuss
- Limited role for medications, however interventions can work well

Concussion Rehabilitation

- Cervical spine ROM, strengthening, manual therapies, postural improvements with physical therapy
- Vestibular rehabilitation for ongoing symptoms of dizziness, ocular symptoms, etc with physical/occupational therapy
- Cognitive rehabilitation for memory impairments, cognitive deficits with speech therapy

Management



Transition back to school	Alert school personnel to injury, initiate slow reintegration when symptoms improve Consider the following: forgive missed assignments, more time for tests/homework, standard breaks and rest periods, distraction free work areas, note taker Avoid standardized testing during recovery Monitor carefully for months after concussion for scholastic difficulties	Usually can be accomplished informally, but formal interventions may be required (i.e. IEP, 504 plan)

Management

Graded return to play	After rest and resolution of symptoms, athletes may progress through this protocol after being symptom free for 24 hours. Each phase should take 24 hours and symptoms should be monitored for. - Non-impact aerobic exercise - Sport-specific non impact drills - Non contact training drills - Full contact practice - Return to normal game play	- Patient must be symptom free and medication free before starting protocol - If any symptoms develop, activity should be stopped immediately; 24 hours after symptoms resolve, protocol may resume at the last step the athlete was asymptomatic

Second Impact Syndrome

- If an athlete returns to play before full resolution of a concussion they are at risk for second impact syndrome
- Disruption of autoregulation of the brains blood supply underlies second impact syndrome
  - Vascular engorgement
  - Diffuse cerebral swelling
  - Increased intracranial pressure
  - Brain herniation
  - Coma and/or death
- Extremely rare

My Child Sustained a Concussion – Now What?

- Lystedt Law – Washington state 2009
- Concussion Management and Awareness Act 2012 passed for NY state public schools
  - Mandates education for coaches, athletic trainers etc.
  - Information provided to parents
  - Prompt removal from athletics until medical clearance
  - Academic accommodations if needed
- Bronxville protocol -
  - Danielle Annis, ATC

Special Considerations

- Team approach between physician, coach, trainers, caretakers, and educators
- Education needs to occur on significance of injury and involve the whole team to ensure compliance
- Education needs to outline potential consequences of noncompliance with activity restrictions
- May need detailed plan for return to school including IEP or 504 plan
- In younger kids, may need to rely more on symptom checklists, team input and gait/coordination

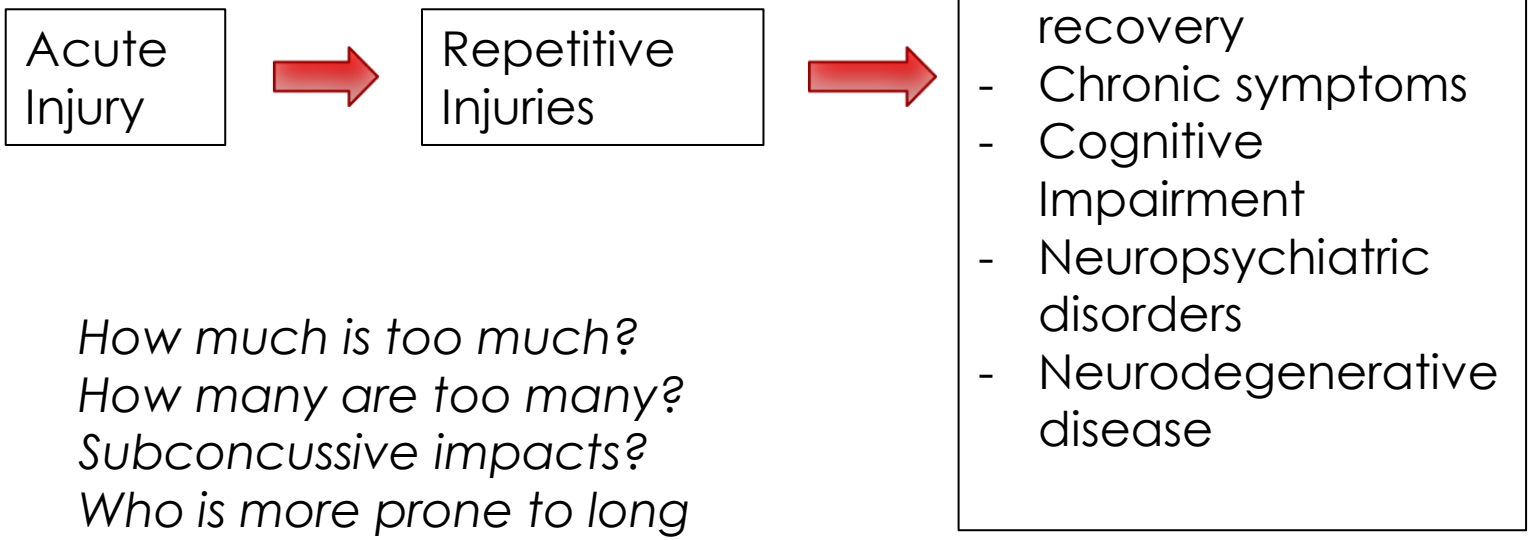
When to Retire an Athlete?

- Contraindications to RTP: ongoing symptoms, abnormal neurologic examination, positive neuroimaging findings
- Clear evidence of impairment on neurocognitive testing
- Increasingly prolonged recovery course after successive injuries
- Less force needed to cause concussions or lasting symptoms
- Multiple concussions sustained in one season
- Can always thinking about changing sports, positions or style of play to lessen risk of concussion

Prevention

- Concussion **proof** helmet? No!
  - Players might feel falsely protected and make dangerous/risky plays
  - Helmets help to decrease catastrophic head injuries such as skull fractures, epidural hematomas
  - Some helmets (such as Riddell Revolution) have been studied that show it can modestly decrease risk of concussion, but nothing is guaranteed
  - Needs to properly fitted, properly worn, and in good condition
- Education/Awareness are key for promoting prevention
- Rule changes are going to be instrumental (NFL spearing, kick off change)
- Role for cervical spine strengthening?

Longitudinal Perspective



How much is too much?
How many are too many?
Subconcussive impacts?
Who is more prone to long term effects?

Conclusions

- Concussions affect up a large number of our pediatric, adolescent and adult athletes and non-athletes each year, especially those in high contact sports
- There are several risk factors for concussion, but most implicated in a history of a previous concussion and +/- LOC
- We need to be wary of children who suffer concussions as their brains are still developing and are more vulnerable
- Symptoms can be grouped into physical, somatic cognitive, and emotional
- Management is rest, rest and more rest
- **When in doubt, sit them out!** (And refer appropriately to HCP's)
- Integrated rehabilitation and concussion management teams can be helpful for an athlete who is not clearing
- Education and awareness are KEY in preventing concussions and other adverse affects of head injury

Resources for Parents

- Columbia Sports Medicine Center for the Developing Athlete website
  - http://www.childrensorthopaedics.com/pediatricsports.html
- CDC "Heads Up"
  - http://www.cdc.gov/concussion/HeadsUp/youth.html
- NYSPHSAA Concussion Information
  - http://www.nysphsaa.org/safety/
- Pediatric Concussion Video – Alexandra's Playground
  - http://www.alexandrasplayground.org/pediatric-concussion-video/