Concussion 2014: An Update

Primary Care Updates
Fort Lauderdale, Florida

February 6, 2014

Content Collaborator
Session 6: Concussion 2014: An Update

Learning Objectives

1. Differentiate concussion presentation from other forms of traumatic brain injury.
2. Implement the latest guidelines for managing the concussion patient including recommendations for returning back to work or sports.

Faculty

Adam T. Chrusch, MD
Drexel University College of Medicine
Temple University School of Medicine
Abington, Pennsylvania

Adam Chrusch is a graduate of the Johns Hopkins University and Temple University School of Medicine. He completed his OB/Gyn internship at Abington Memorial Hospital then completed his family medicine residency training at Abington Memorial Hospital. He then furthered his training with a fellowship in sports medicine. He has published and presented his research on knee kinetic and kinematic forces at the American Medical Society for Sports Medicine's National meeting. He has also published and presented cases dealing with Chiari malformations related with recurrent concussions and high output congestive heart failure exacerbated by anemia and deep water emersion. Dr Chrusch is currently the medical director for the school districts of Jenkintown and Wissahickon. He is also the family medicine clerkship director for the Drexel University School of Medicine, Thomas Jefferson Medical College, Temple University School of Medicine, and Philadelphia College of Osteopathic Medicines’ Family Medicine clerkship. He is currently working with the Abington Neurosciences Institute to provide expedited evaluation and care for athletes with head injuries, specifically concussion, through the Abington Memorial Hospital’s concussion hotline (215-481-HEAD). Dr Chrusch’s special interests include musculoskeletal medicine, athletic event coverage as well as non-operative treatments dealing with degenerative joint disease and overuse injuries. He has a strong interest in care of the endurance athlete and he himself has competed in several triathlons. He is also strongly interested in serving the underserved in the Abington/Jenkintown/Philadelphia area, by providing annual physical exams to underserved children of the Jenkintown and Wissahickon school districts as well as caring for those who have little or no health insurance.

Faculty Financial Disclosure Statement

The presenting faculty reports the following:

Dr Chrusch has no financial relationships to disclose.

Suggested Reading List


**Session 6**
3:45–5:15pm

Concussion 2014: An Update

**Speaker**
Adam T. Chrusch, MD, CAQ

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**Presenter Disclosure Information**

The following relationships exist related to this presentation:

► Dr. Chrusch has no financial relationships to disclose.

**Off-Label/Investigational Discussion**

► In accordance with pmIcme policy, faculty have been asked to disclose discussion of unlabeled or unapproved use(s) of drugs or devices during the course of their presentations.

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**Concussion 2014: An Update**

Adam T. Chrusch, MD, CAQ
Sports Medicine
Adjunct Assistant Professor of Family Medicine
Drexel University College of Medicine
Assistant Program Director
Abington Family Medicine Residency

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**Learning Objectives**

• Differentiate concussion presentation from other forms of traumatic brain injury
• Implement the latest guidelines for managing the concussion patient including recommendations for returning back to work or sports

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**Traumatic Brain Injury**

• Traumatic vs. Non-traumatic
• Closed vs. open head injury
• Right Hemisphere vs. Left Hemisphere
  – Right side- art, problem solving
  – Left side- concrete thinking, language, math

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**Non-Traumatic Brain Injury**

• Aneurysms
• Intracranial bleeding
• Tumors
• Ingestion or inhalation of solvents (huffing)
• Alcohol or Drug abuse
• Hypoxia
  – Drowning, Strangulation
• Infections (meningitis)
Traumatic Brain injuries

- Open Head injuries
  - Gunshot
  - Car accident
  - Skull fracture (fights)

- Closed Head injuries
  - Subdural/ Epidural hematomas
  - Concussion (Mild Traumatic Brain Injury)
  - Shaken Baby Syndrome

Mechanism of Injury

- Coup injury: a direct blow to a stationary skull that compresses/injures underlying brain at the point of impact.
- Contra-coup: injury to brain tissue on the opposite side of a blow or force as a result of a moving brain rebounding against the skull or from tearing of fragile subarachnoid vessels.
- Rotational: injury to brain tissue as a result of shearing forces between the skull and brain tissue.

Intracranial Bleeding

- Subdural or Epidural vessels are lacerated from sheer force
- Dysfunction may be immediate, delayed or even have a lucent period

Concussion

- Latin concussus means “to shake violently”
- Definition: Traumatically induced transient disturbance of brain function and involves a complex pathophysiological process. It is a subset of Mild Traumatic Brain Injury (MTBI) which is generally self limited and at the less-severe end of the brain injury spectrum

Several common features:

- Caused by direct blow
- Usually results in rapid onset of impairment
  - May be delayed by 72 hours
- Resolves spontaneously
- Functional not structural injury
- Grossly normal neuroimaging
- Loss of consciousness (LOC), symptom resolution in sequential course
Epidemiology

- Self report data suggests significantly higher incidence of concussion
- Exact incidence of concussion and sequelae are unknown because of under reporting and recognition
  ➢ Have you had a concussion → NO!
  ➢ Have you had your “bell rung, dusting of cobwebs, shaking off your head” → YES

Concussion Complications

- Second Impact Syndrome
- Post-Concussion Syndrome
- Long Term Cognitive Changes
- Death and Morbidity

Second Impact Syndrome

- Most serious complication of Concussion
- 1st impact usually w/ LOC
- Second impact occurs prior to symptom resolution
- Occurs secondary to a loss of autoregulatory system → vascular engorgement → marked increase in intracranial pressure → brain herniation → coma or death

Post-Concussion Syndrome

- Occurs in up to 6.5% of cases
- Persistent physical, emotional, and cognitive symptoms past 3 or 6 months
- Risk factors
  - Increasing age, female sex, non-sports related concussion (MVA, assault)

Post Concussion Syndrome

- Treatment
  - Formal Neuropsychological consult and testing
  - Cognitive therapy
  - Integrated Neurorehab programs
    • PT/OT/Speech/Vestibular therapy
  - Supervised Progressive exercise programs
    • Baseline exercise to level of symptoms
    • Every other day exercise to 80% of symptom threshold
    • Frequent reevaluation of symptom threshold

Long Term Effects

- Decrease academic performance
- Irritability
- Photophobia, Phonophobia
- Sleep disturbance
- Migraines
- Depression
- Suicide
Chronic Traumatic Encephalopathy

- Increased Tau protein in the brain
- From repetitive brain trauma
- Diagnosed on autopsy
- Symptoms include: executive dysfunction, memory impairment, depression and poor impulse control
- Not a continuation of Post Concussion Syndrome
- Happens years later
- Likely a genetic component
- May have no previous concussion history

Brain Imaging Behavior. 2012; June 6(2):244-254.

NFL Settlement

- 765 million dollars
- Equates to 1 million dollars per franchise for the next 20 years
  - 50% of settlement to be paid in the first 3 years
  - then 50% over the next 17 years
- Also 75 million for medical exams for ex-players
- 10 million in concussion research


Concussion Guideline History

- American Academy of Neurology
  - Neurology 1997
- Cantu
  - Physician in Sports Medicine 1986
  - Clinics in Sports Medicine 1998
- Colorado Medical Society
  - Denver County Medical Society 1990
- International Conference on Concussion in Sports
- American Academy of Neurology 2013

Colorado Medical Society 1991

- Grade 1- Transient confusion, no amnesia, no LOC
- Grade 2- no LOC, brief amnesia
- Grade 3- any LOC


American Academy Neurology Guidelines 1997

- Grade 1- No LOC, transient confusion, symptoms clear within 15 minutes
- Grade 2- No LOC, symptoms more than 15 minutes
- Grade 3- Any LOC


PRAGUE 2004

(2nd International Conference on Concussion in Sport)

- Simple and Complex Concussion
- Cornerstone of management is rest and a graded program of exertion before return to sport

Zurich Guidelines 2008

- Simple and complex nomenclature removed
- Grading is removed totally
- Focus shifted to resolution of symptoms prior to return to play
- Graded return to play was implemented
- Supported the use of SCAT 2 (Sports Concussion Assessment Tool)


AMSSM: 2012 Position Statement: Concussion in Sport

- Reviewed literature on sport specific rates (per 1000 athlete exposures)
  - Football 0.37-0.64
  - Ice Hockey 0.41-0.54
  - Men’s Soccer- 0.17-0.28
  - Women’s Soccer- 0.13-0.41


AMSSM: 2012 Position Statement: Concussion in Sport

Risk factors
- One Previous Concussion- 2-5.8x more likely to have a subsequent concussion
- Increased number of concussions predict a longer recovery
- Dizziness- greatest predictor of recovery >21 days
- Women-men
- Age- younger = more concussions and prolonged recovery


AMSSM: 2012 Position Statement: Concussion in Sport

Risk Factors (cont.)
- Position- linebackers, running backs, quarterbacks
- Soccer- illegal activity and not purposeful heading
- Genetics- mixed data
- Mood disorders- no evidence to increase concussion, but complicate recovery
- Learning Disabilities- pre-injury ADHD may prolong recovery although mixed data

Migraines and Concussion

- Migraines complicate management
  - Link between pre-existing migraine and increased concussion rates
    - One small retrospective study
  - Pre-existing migraine does not seem to prolong recovery
    - 3 studies
  - Post concussion migraine complex (headaches, dizziness, noise/light sensitivity, nausea, vomiting, balance problems) have a prolonged course of recovery

Symptom Management

- Avoid drugs that can alter mental status in the first 10 hours
- After 10 hours symptomatic treatment could be considered
  - CNS modifying drugs are still recommended against (examples- Stimulants, Sedatives, antidepressants)
**Headache Medications**

- **Acute setting (0-10h)**
  - Avoid Aspirin, NSAID’s due to bleeding risk
  - Acetaminophen offers a possible benefit with minimal risk
- **Recovery phase**
  - “after 3-4 days, abortive treatment should be tailored to the headache type.”
  - “Prophylactic Treatment should be tailored”

**Sleep Disturbance Treatment**

- **Acute phase (“first few days”)**
  - Manage conservatively without medications
  - Sleep hygiene
  - No role for stimulants or depressants
- **Post concussion syndrome**
  - “both medical and cognitive therapies may be considered”

**Alteration of mood treatment**

- Any mood disturbance is possible
  - Depression -- most common
    - Acute phase -- no role for anti-depressant medications
    - If symptoms persist (6-12 weeks):
      - “treatment with medications and/or cognitive therapy should be considered”

**Cognitive Symptoms -- Decreased Attention**

- No role for stimulants in the acute phase
- Decreased workload is recommended

**Balance difficulty**

- “meclizine and diazepam may be helpful for acute attacks of vertigo”
  - Use carefully due to medication ability to obscure evaluation, increase fatigue
- **Vestibular Therapy**
  - Limited evidence supporting, but little risk

**Balance Testing**

- Reviewed the evidence for the Balance error scoring system (BESS)
  - Hands on hips
  - Eyes closed
  - Each stance 20 seconds
  - Both feet, one foot on each side
  - Points are deducted for removing hands, opening eyes, stepping, falling
  - Actual test requires two different surface materials (hard and medium density)

American Academy of Neurology

2010 Position Statement

1. Education efforts should be maximized...AAN supports the CDC’s Heads Up: Concussion in youth sports training module
2. Athlete should be removed from play with symptoms
3. No Return to Play with symptoms
4. Should be cleared by a license health care professional properly trained in evaluation and management of concussion
5. Legislators should implement concussion registries.
6. High schools and athletic associations should use a tool such as the Standardized Assessment of Concussion (SAC).


American Academy of Neurology

2013 Summary of Evidence

• Females have a greater risk although lower total concussions (1)
• American Football and Australian Rugby have the highest rates of concussion (2)
• Women’s soccer has the highest risk for women (1, 2)


American Academy of Neurology

• Practice recommendations
  – Pre-participation
    • School based officials should be educated
    • Physicians should educate patients and families about risks of concussion


American Academy of Neurology

• Practice Guidelines (continued)
  – Inexperienced Physicians should be instructed on how to evaluate a concussion
  – Evaluation should include a validated tool
    • SCAT 2 or SAC
  – Player should be immediately removed from play and no return to play the same day

Investigational Advanced Imaging

• Functional MRI
• Diffusion tensor imaging
Sport Concussion Assessment Tool (SCAT)

- Derived from the Prague 2004 guidelines, validated at Zurich 2008
- Goal was to create a standardized tool that could be used for patient and physician assessment of sports concussion.
- Recommend using as a baseline neuropsychological screening tool with Pre-Participation Evaluation
- Neuropsychological screening for "organized high risk sports" regardless of age or level of performance
- Standardized Assessment of Concussion (SAC) included in SCAT 2
- SCAT2 has been updated to SCAT3

Follow Up Instructions

Instructions need to be given for unresolved symptoms post injury:
1. Worsening headache
2. Unresolved vomiting
3. Unable to be aroused
4. Seizures
5. Slurred speech


Graduated Return to Play

1. Rest until asymptomatic (buffer included)
   - Neurologic and balance exam normal
2. Light aerobic exercise (increase HR 20 minutes)
3. Sport specific exercise (lateral movement, no sprinting)
4. Non-contact training drills (sprinting and cutting, full protective gear, no contact)
5. Full contact training
6. Return to competition

Follow Up Instructions

- Schedule follow-up appointment
- No contact activity (physical rest)
- Cognitive rest
- Inform guardian of expected course of concussion
- If worsening symptoms or unresolved symptoms → call physician

Computer Based Neuropsychological Testing

- Several Available
  - Automated Neuropsychological Assessment Metrics (ANAM, military)
  - Axon Sports
  - Head Minder
  - Concussion Vital Signs
  - ImPACT

Formal Neuropsychological Testing

- Pencil and Paper
  - Administered by a Neuropsychologist
  - More comprehensive
    - Tests more domains
  - More expensive
  - May identify other disease state masquerading as post concussion syndrome
  - Cannot be retested for at least 6 months
Brain STEPS

- Strategies
- Teaching
- Educators
- Parents
- Students

Return to School

- No guidelines for return to school
- Common Recommendations
  - No gym activity
  - 50% more time for assignments and testing
  - Reduce homework and testing by 50%
  - Frequent rest breaks for symptoms (nurses office)
  - Half or Full days off from school
  - Request an Individual Educational Plan (IEP), Section 504 plan


Return to School

- “Effect of Cognitive Activity Level on Duration of Post-Concussion Symptoms”
  - Published Pediatrics 1/6/2014
  - 335 sports concussions
  - Symptom Score assessed (included in the SCAT)
  - Students recorded date of last symptom
  - Cognitive Activity level was reported at each visit


Cognitive Activity Scale

- 0- Complete Cognitive Rest
  - Complete rest- No reading, homework, texting, video games, online activity, some TV, videos or listening to music
- 1- Minimal Cognitive Activity
  - No reading, homework, crossword puzzles or similar activities. Less than 5 texts/day. Less than 20 min/day combined homework, online, video games
- 2- Moderate Cognitive Activity
  - Reading less than 10 pages/day, less than 20 texts/day, less than 1 hour combined homework, online, video games
- 3- Significant Cognitive Activity
  - Reading less, doing less homework, less online, texting less and doing more other activities than listed in 2, but less than normal
- 4- Full Cognitive Activity
  - No limited cognitive activity


Results

- Kaplan-Meier Curve of Symptoms Generated
  - Group 4- took significantly longer to recover
  - Groups 1-3- improved at similar rates
  - Group 3 took longer than 1, 2 but not significant


Return to School

- Take Away Points
  - First Study to quantify amount of time for homework, text messages ect. in a prospective study
  - We usually prescribe level 3
  - Perhaps Level 2 would be helpful
    - <10 pages/day, <20texts/day, <1hour of homework, online, video games
  - Complete removal from Cognitive Activity is unnecessary
  - Study did not address variation of activity over time
  - Scale is not a validated tool (Developed by 2 concussion Specialists)

Return to work

- No current guidelines
- Decreased physical labor, part time
- Limit driving if this causes symptoms
- Presenteeism vs. Absenteeism
- Short term disability, Worker’s Compensation, MV insurance, lawsuits


Abington Memorial Hospital Concussion Referral Service

- Concussion hotline (215-481-HEAD)
  - 8:00 AM-4:00 PM
  - Appointment with a Concussion Specialist within 48 hours
  - Weekend and Nights are covered via answering service until 11PM

PT/OT/Speech Therapy

- Physical Therapy/Vestibular Therapy
  - Balance training, coordination, return to sport
- Speech Therapy
  - Visual memory, reading, comprehension,
- Progressive Exercise Programs

Prevention

1. Legislation
2. Education
3. Protective equipment

Legislation

- Lystedt Law (Washington)
  - Effect?
    - Survey sent to Adults associated with Washington Youth Soccer 1 year after Passage
      - 63% parents, 20% coaches, 17% non-coaches
      - 96% knew Concussion was a brain injury
      - 93% knew Concussions were serious
      - 93% knew that recognition and proper response could prevent further injury or death


Safety in Youth Sports Act (PA Act 101)

- Schools may provide informational sessions prior to the start of athletic seasons
- Students must be removed from play when concussion symptoms are observed
- Athletes must be cleared in writing by an “Appropriate Medical Professional
- Coaches must attend yearly concussion course
- Penalties to coaches will involve suspension if they disregard current guidelines
- Law took effect July 2012

Safety in Youth Sports Act.
Heads Up Program

• Module with questions
• Online
• Available on the CDC’s website
• Free


Protective equipment

Helmets

• AAN and AMSSM guidelines state there is insufficient evidence that helmets prevent concussions


Protective equipment

Mouth Guards

• AAN and AMSSM guidelines suggest insufficient evidence that mouth guards prevent concussion


How many is too many?

• No one knows
• Guskiewicz et al. Neurosurg 2005
  – NFL players with >3 concussions:
    • 5x more likelihood to be diagnosed with Mild Cognitive impairment
    • 3x more significant memory problems
  – NFL players with 3 concussions:
    • 3x incidence of depression
  – NFL Players with 1 or 2 concussions
    • 1.5x incidence of depression

Summary

• Same day return to play is not legal!
• Treatment of choice: Rest, but not complete rest
• Concussions are serious and not to be taken lightly.
• Evidence surrounding concussion is growing exponentially, and physicians should stay up to date.

Question & Answer