Importance of Recognizing a Concussion

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KVL Coach’s Meeting
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FIFA World Cup 2014

• **Alvaro Pereira**: Uruguay vs. England
  – Unconscious on the field
  – Argued with medical staff
  – Allowed to return to game

• Championship game
  – Christoph Kramer laid on the field for several minutes
  – Played for ~15 minute after injury
  – Had to ask referee if it was the championship game
Definition

- AMSSM Position statement (2012):
  - A traumatically induced transient disturbance of the brain function and involves a complex pathophysiological process.
  - **Subset of mild traumatic brain injury (MTBI)**, which is generally self-limited and at the less-severe end of the brain injury spectrum.

- Current Concepts in Concussion: Evaluation and Management (AAFP 2012)
  - Disturbance to brain function caused by direct or indirect forces → **FUNCTIONAL** injury, not structural
Pathophysiology

- Linear and/or rotational forces are transmitted to the brain.
- **No known biomechanical threshold for clinical concussion.**
- “Neurometabolic cascade” underlying the clinical presentation of a concussive injury describes a complex cascade of ionic, metabolic and pathophysiological events that is accompanied by microscopic axonal injury.
- **More pronounced in youth**
Incidence

• Increased annual concussion rates over past decade
  – Better reporting?
• Sports concussions: 1.6 – 3.8 million annually
  – 5-9% of all sports related injuries
• > 1 million ED visits annually (underreported)
• 1,700 NFL players, 66,000 collegiate, 1.1 million high school, 250,000 Pop Warner
• Consistently higher rates in competition than practice
• At high school and collegiate level: higher incidence of concussions reported in females
### Incidence

**AMSSM Position Statement: Concussion in Sport**

<table>
<thead>
<tr>
<th>Table 2: Concussion rates per 1000 athlete exposures</th>
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<tbody>
<tr>
<td>-------------</td>
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<tr>
<td><strong>Level</strong></td>
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<tr>
<td>Baseball</td>
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<td>Wrestling</td>
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<td>Ice hockey</td>
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**Overall** | 0.17        | 0.28        | 0.43        | 0.24        | 0.24        |

*NR, not reported.*

- Football: 0.33 - 0.64
- Boy’s soccer: 0.17 - 0.28
- Girl’s soccer: 0.13 - 0.41
Signs and Symptoms

- Non-specific:
  - #1: Headache
  - #2: Dizziness
  - LOC in < 10% of concussions
  - 59% of college athletes with concussion-like symptoms in the prior year
  - 50-84% of high school athletes report symptoms of concussion at baseline testing.

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### Box 1  Signs and symptoms of a concussion

- **Physical**
  - Headache
  - Nausea
  - Vomiting
  - Balance problems
  - Dizziness
  - Visual problems
  - Fatigue
  - Sensitivity to light
  - Sensitivity to noise
  - Numbness/tingling
  - Dazed
  - Stunned

- **Cognitive**
  - Feeling mentally ‘foggy’
  - Feeling slowed down
  - Difficulty concentrating
  - Difficulty remembering
  - Forgetful of recent information and conversations
  - Confused about recent events
  - Answers questions slowly
  - Repeats questions

- **Emotional**
  - Irritable
  - Sadness
  - More emotional
  - Nervousness

- **Sleep**
  - Drowsiness
  - Sleep more than usual
  - Sleep less than usual
  - Difficulty falling asleep

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AMSSM Position Statement: Concussion in Sport
Diagnosis

- Diagnosis: Temporal relationship between mechanism of injury and onset of symptoms must be established
- DOES NOT HAVE TO BE A DIRECT HEAD IMPACT
- DO NOT GRADE ANY LONGER
Risk Factors

• Prior history of concussion (2-5.8 fold increase)
  – Severity or duration of symptoms of prior concussion
• Female
  – Tend to have longer duration of symptoms
  – Decreased head-neck mass?
  – More honest report?
• Youth
  – Tend to have prolonged recovery and higher rate of catastrophic injury
  – Developing brain?
• Style of play / position / sport
  – Most common mechanism is player-to-player contact
  – Football:
    • Skill players 3x greater risk than lineman
    • Kickoff 4x greater risk than rushing/passing plays
    • Linebackers with highest rate on defense
  – Soccer:
    • 25.3% of concussions due to illegal activity in a study at the high school level
    • Prospective college level study: No increased risk with heading
  – Hockey:
    • Most common mechanism is checking
Risk Factors

- Genetics:
  - APOE e4, APOE G-219T, tau exon 6
  - Limited studies
- Depression or other mood disorders
  - No evidence that it predisposes to concussion
  - May complicate recovery (new symptom vs. exacerbation of baseline)
- History of ADHD or learning disabilities
  - May complicate recovery (share symptoms: difficulty with memory, attention, concentration)
- Migraines
  - May be a risk factor and may prolong recovery
  - 10% of general population
  - 22% Australian rules football
  - 2.9% NCAA athletes
Management: Initial Presentation

• ABC’s
  – First step is to check Airway, Breathing, Circulation

• Cervical spine exam
  – Nexus Protocol (Midline spine tenderness, Focal neurological deficit, Altered level of consciousness, intoxication, distracting injury?)
  – Football helmet and shoulder pads are a unit, leave both on or take both off.
  – Local AMR is spineboarding athletes less now
Management: Coach / Athletic trainer

- Utilize a standardized approach to reduce degree of subjectivity.
- History
- Cognitive testing
- Neurological testing
- Balance testing (BESS)
Management:

NFL Sideline Concussion Assessment Tool: Completed by healthcare professional. Athlete completes symptoms at bottom.

**Orientation / SAC**
- What month is it? ______ 0 1
- What is the day of the week? ______ 0 1
- What year is it? ______ 0 1
- What is time now? ______ (within an hour) 0 1

Total score: out of 5 ______

**Maddox’s Questions**
- Where are we? ______ 0 1
- What quarter is it now? ______ 0 1
- Who scored last in the practice / game? ______ 0 1
- Who did we play last game? ______ 0 1
- Did we win the last game? ______ 0 1

Total score: out of 5 ______

**SAC / Word Recalls**
- List 1: Immediate Recall Trials #1 #2 #3
- Alternative Lists
- Delayed recall (perform at end of all sideline testing, at least 5 minutes)

Total of all three immediate word recalls: out of 15 ______
Total delayed recall: out of 5 ______

**NFL Concussion Symptom Checklist**

- Do you feel? The athlete should score themselves on the following symptoms, as applicable, based on how they feel at the time. (i.e. not present, mild, mild to moderate, moderate, severe)
  - Headache / head pain
  - Nausea / vomiting
  - Neck pain
  - Dizziness
  - Vision problems / blurred vision
  - Balance problems
  - Fatigue / low energy
  - Fatigue / low energy
  - Confusion
  - Feelings of fear
  - Feeling “in a fog”
  - Difficulty concentrating
  - Do symptoms worsen with physical activity? Y N
  - Do symptoms worsen with mental activity? Y N

Total # symptoms ______ of 24 (42 max if 24 x max 6 = ______ of 24)
Management: Neuroimaging

- Vast majority of athletes with sports-related concussions do NOT require neuroimaging
  - CT and MRI will be normal
- CT: if concern for fracture or intracranial bleed
- MRI: if concern for underlying pathology or persistent symptoms (headache or seizure activity)
  - IE: AV malformation, Chiari malformation
- Functional MRI: abnormal patterns of activation have been noted in concussions
  - Does not change management
Management: Neurophysiological testing

• Written: neurophysiologist (time consuming but can assess more domains)

• Computerized (ie: ImPACT, Concussion Vital Signs (CVS), XLNTbrain Sport, Computerized Cognitive Assessment Tool (CCAT), Concussion Resolution Index (CRI)): easier to administer, cheaper

• Has NOT been validated as a diagnostic tool, but has the ability to show cognitive deficits longer than athletes are symptomatic
  – No universally agreed upon recommendations for testing, current recommendations are based on expert opinions
ImPACT testing

- **Immediate Post-Concussion Assessment and Cognitive Testing**
- Impact: 20 min computer test measuring verbal and visual memory, processing speed, reaction time, and impulse control.
- Theory: have baseline test for healthy athlete to compare cognitive function after injury
- > 7,000 Pro teams, colleges, high schools
  - NFL, MLB, MLS, NHL
  - Cooperate partners (Dick’s, Wells Fargo, Overland Park Regional)

- **St. Francis Health DOES offer (see next slide)**

- **Washburn University, USD 501 HS, and Seaman HS uses ImPACT to tests student athletes for baseline and post-injury**
- **Washburn Rural HS uses CVS**

- **It is a tool in the toolbox, use it to assist, not make the decision.**
Concussion Management for Sports Injuries

Baseline Testing: $40  
Post-Concussion Test: $50

Ages Starting at 10 years old  
Tests performed every 2 years throughout sport performance.  
Credentialed Sports Medicine Physician on staff.

Call to schedule an appointment  
785.228.1700

Sports Medicine Center
801 SW Fairlawn Topeka, KS 66606 | 785.228.1700

We proudly use ImPACT, The most scientifically validated computerized concussion evaluation system, leading concussion management standards, providing the highest standards of care and safe return to play.
Management: Medications

• No convincing evidence that any particular medication is effective in treating the acute symptoms of sports concussion
• In acute setting (0-10 hr post injury), avoid any drugs that could alter mental status
• Caution with anti-nausea and anti-depressants
  – Can effect CNS
• Avoid Ibuprofen (Advil, Motrin) or Aleve (Naproxen) and Aspirin → risk for intracranial hemorrhage
• Tylenoal (Acetaminophen) only
• Recommend dim, quiet environment
  – Limit reading and screen time
• Good sleep hygiene -> Allow athlete to sleep, no longer need to wake up every 30 minutes
Management:

• No specific treatment except relative physical AND cognitive rest

• Natural history: symptoms present immediately, usually last > 72 hrs, most resolve spontaneously within 7-10 days
  – But 3-4 weeks is still considered NORMAL

• Predicting recovery time:
  – Dizziness at time of injury found to be greatest predictor in high school football players for a recovery > 21 days
  – Athletes with more symptoms in cognitive or migraine symptoms often required more recovery time

• Worsening symptoms could indicate intracranial pathology and warrants advanced imaging
Management: Return to Activities

• Return to school PRIOR to return to sport
• No standardized guidelines for returning athlete to school
  – May use ACE form -> Currently working with local school districts to have a unified Topeka Metro form
• May require academic accommodations initially
  – Reduced workload
  – Extended test-taking time
  – Shortened school day
• American Medical Associate (AMA) passed policy in June 2015:
  – Recommends requiring young athletes who are suspected of having a concussion to be quickly removed from a game, the group said in a statement, and allowed to return only with a physician’s written consent.
ACE Form

Name: [Redacted]
CM CFT Birthdate: [Redacted]
Date of Injury: [Redacted]

Return to Learn

Classroom Learning

KSCP Rx

Do NOT allow student to participate in the following:
- PE class
- Weightlifting
- Band or Music
- Wood shop or Metal shop
- Debate and Forensics
- Homework
- Exam or Quizzes
- Research Papers
- Computer Lab
- Videos or Movies
- Other:

Please accommodate the student in the classroom by:
- Extending test time
- Allowing quiet work time (in library, for example)
- Adjusting assignments, due dates, etc.
- Providing a tutor
- Creating an individualized learning plan
- Other:

Full Schedule & Accommodations

Step 1.
Light aerobic exercise, including walking or riding an exercise bike. No weightlifting. (Increased heart rate)
- Step 1 completed successfully
- Athlete reports no return of symptoms after 24 hours.
- Coach/Athletic Trainer
- Date
- Notes:

Step 2.
Running in a gym or on the field. No helmet or equipment should be used. (Add movement)
- Step 2 completed successfully
- Athlete reports no return of symptoms after 24 hours.
- Coach/Athletic Trainer
- Date
- Notes:

Step 3.
Non-contact training drills and full equipment. Start light resistance training or light weight training. (Add specialization and weight
- Step 3 completed successfully
- Athlete reports no return of symptoms after 24 hours.
- Coach/Athletic Trainer
- Date
- Notes:

Step 4.
Full-contact training under the supervision of the coach/athletic trainer. (Resume confidence and assess functional ability)
- Step 4 completed successfully
- Athlete reports no return of symptoms after 24 hours.
- Coach/Athletic Trainer
- Date
- Notes:

Return to Play

Student may fully Return to Play if all the above steps were successfully completed without return of any symptoms. This includes full participation in live competition or practice. Symptoms of concussion may develop within days after a head injury. Patient should continue to be observed for any new symptoms.

Medical Professional Signature: [Redacted]
Date: [Redacted]
Scheduled Follow-up Date: [Redacted]

Notes:

When can the student-athlete return to school? It will depend on the individual. Every student's injury and recovery is unique and requires careful observation from parents and doctors. For prompt recovery and prevent ongoing symptoms by following the Return to Learn plan, see the one below. The physician will authorize a plan to return to student's normal activities.

Schools should identify a team leader to work with each student-athlete to maintain a communication system between the physician, athletic trainer, school administrator, teachers, coaches, school nurse, school counselor, parent/guardian and any other members.

- STUDENT MAY NOT ATTEND SCHOOL AT THIS TIME. Student may not attend class or participate in any activities, including school work assignments, reading projects, etc. This includes any extracurricular activities, such as all athletic activity, weightlifting, gym class, band, music, debate, etc. Continue to limit all activities that can worsen symptoms, such as loud music, television, computer games, etc.

- PARTIAL SCHEDULE & ACCOMMODATIONS. Student may attend school with a partial class schedule. Work with the student to help determine the most appropriate schedule. Classes should be prioritized and not worsen symptoms. Special accommodations may be required to limit symptoms, e.g., longer class periods, reduced grades, and other activities that can worsen symptoms. Students may also participate in non-athletic extracurricular activities, such as band, music, and other activities.

- FULL SCHEDULE & ACCOMMODATIONS. Student may participate in a normal class schedule, but will still require some accommodations, depending on their current symptoms. Continue to work with the student to identify any specific classroom activities that can worsen symptoms. Student may be allowed to participate in all school activities, but class attendance should be limited during this time. Participation in all extracurricular activities, weightlifting, gym class, and other extracurricular activities is still fully restricted.

Normal Classroom: Student is NOT allowed to participate in any physical activity, such as walking, jogging, drills, practice or games. The student is NOT allowed to return to "Normal to Play" but may fully participate in all normal classroom activities. Work with the student to ensure a return to school is included in the plan.

After participation in the copepep or if symptoms remain or if the athlete reports no return of symptoms after 24 hours, Physical therapist should use the "Return to Play Release Form." A form is completed for Return to Play can be safely started. Once the Return to Play progression is fully completed without return of symptoms, the athlete should be cleared for all athletic activity, weightlifting, and gym class with restrictions.

Concussion symptoms may develop within days after a head injury. The patient should continue to be observed for any new symptoms.
Return to Play Progression

**Baseline (Step 0):** As the baseline step of the Return to Play Progression, the athlete needs to have completed physical and cognitive rest and not be experiencing concussion symptoms for a minimum of 24 hours. *Keep in mind, the younger the athlete, the more conservative the treatment.*

**Step 1:** Light Aerobic Exercise  
The Goal: only to increase an athlete’s heart rate.  
The Time: 5 to 10 minutes.  
The Activities: exercise bike, walking, or light jogging.  
Absolutely no weight lifting, jumping or hard running.

**Step 2:** Moderate Exercise  
The Goal: limited body and head movement.  
The Time: Reduced from typical routine  
The Activities: moderate jogging, brief running, moderate-intensity stationary biking, and moderate-intensity weightlifting

**Step 3:** Non-contact Exercise  
The Goal: more intense but non-contact  
The Time: Close to Typical Routine  
The Activities: running, high-intensity stationary biking, the player’s regular weightlifting routine, and non-contact sport-specific drills. This stage may add some cognitive component to practice in addition to the aerobic and movement components introduced in Steps 1 and 2.

**Step 4:** Practice  
The Goal: Reintegrate in full contact practice.

**Step 5:** Play  
The Goal: Return to competition
Premature Return to Play

• May predispose athlete to a subsequent concussion with prolonged recovery
  – Decreased cognitive ability and reaction time when recovering

• Second Impact Syndrome (SIS)
  – Second injury prior to the first healed
  – More common in boxers or athletes < 18 y/o
  – Loss of auto-regulation of brain’s blood supply, leading to vascular engorgement, increased intracranial pressure, brain herniation → coma or death
  – **Mortality rate ~50%**
  – **Morbidity / disability rate ~100%**
  – 35 cases of suspected SIS from 1980-1993 in American football players
Post-concussion Syndrome

- Defined as symptoms and signs of concussion that persist for weeks to months
- Difficult to define where concussion ends and post-concussion syndrome begins
- Foundation of management is TIME → slow recovery process, often frustrated due to limitations in daily life (school, work, sports)
- Ideally managed by a team of providers who work with concussion on regular basis
Long Term Sequelae

- Increasing concern and coverage regarding Chronic Traumatic Encephalopathy (CTE)
- CTE is NOT a continuation of post-concussion syndrome or symptoms from an acute concussion, but rather develops decades after exposure.
- Neurodegenerative disease associated with repetitive brain trauma.
- Diagnosed post-mortem due to accumulation of Tau protein in specific areas of the brain.
- Not all former athletes diagnosed with CTE had reports of prior concussion.
  - Does sub-concussive blows contribute to development of disease?
Disqualification from Sports

- No evidence-based guidelines for disqualifying or retiring from sport after concussion
- No agreed upon absolute number of concussion prior to disqualification
- Discuss each case with athlete and family
  - Risks: multiple concussions, abnormality on neuroimaging, persistent diminished academic or workplace performance, persistent post-concussive symptoms, prolonged recovery courses
Prevention
Prevention

• No evidence that protective gear prevents concussions.
  – They reduce the risk of skull and dental fractures.
  – Proper fitment is more important than style
• In 2009, Washington state enacted the Zackery Lystedt Law – required education for coaches, athletes, and parents
Prevention

- Impossible to prevent all sports-related concussions
- **Education is key**
- **Attitude shift is essential**
  - Players, coaches, officials, administrators, parents, fans
- **Modification of rules**
  - NFL banning spear tackling in 1976
  - Hockey banning checking from behind
    - Checking prohibited in leagues < 13-15 y/o
  - Soccer limited ‘elbow to head’ contact
CDC Concussion

http://www.kansasconcussion.org/
Referral

- Peter Loo, MD
- Sports Medicine Clinic at St. Francis Health Brewster Place
- 1101 SW 29th St.
- 785-379-4600

- Staff at my clinic has been instructed that these student athletes are to be scheduled within 24-48 business hours to be seen
Summary

- Concussions do not require a direct blow to the head
- Pull athlete out of activity for the day if any concern (state law)
- CT scans will be normal for concussions
- Cautious when starting medications post-injury
  - Avoid Ibuprofen and Aleve
  - Tylenol only for pain
- Allow to rest from both physical and mental activities
- Return to school before Return to play (RTP)
- RTP progression
- Education is key
Questions
References

- http://www.aafp.org/afp/2012/0115/p123.html
- http://www.cdc.gov/headsup/
- http://bjsm.bmj.com/content/47/5/250.full.pdf+html
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