


1  **Concussion**

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2 3  **Objectives**

- Be able to recognize signs and symptoms of concussion
- Be familiar with sideline management
- Be aware of the Zurich Consensus Statement and its elements
- Have a plan for Return to Play
- Be aware of Second-Impact Syndrome
- Be aware of Postconcussive Syndrome and its treatment options
- Be aware of Texas SB 835 a.k.a. Tasha's Law

4  **Why we care**

- Nathan Stiles
 - October 28, 2010
 - Kansas HS linebacker intercepted a ball and was tackled (some say hard, some say routine)
 - Ran to sideline complaining of HA
 - Tried to stand but collapsed and lost consciousness
 - Began "seizing"...some reports of difficulty breathing
 - Life Flighted to KU Hospital
 - Pronounced at 0400
 - Reportedly had been cleared by PCP earlier in week from 2 week old concussion

5  **Statistics**

- Most common head injury in athletes
- Estimated 300,000 sports-related TBIs in the US annually.
 - Predominantly concussions
 - Up to 50% go unreported
- NCAA Data
 - 37% from football, 13% women's soccer, 9% women's basketball, 7% men's basketball
 - Football had highest rate of concussion, followed by hockey, then soccer and wrestling.

6  **Definition**

- A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

7  **Definition**

- May be caused either by a direct blow to the head, face neck or elsewhere on the body with an "impulsive" force transmitted to the head.
- Typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.

8  **Definition**

- May result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
- Results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.

9  **Definition**

- There is no abnormality on STANDARD structural neuroimaging studies seen in concussion.

10  **Some History**

- Cantu
 - 1986-Guidelines on treatment and RTP based on a graded system depending on symptoms & duration
- Colorado
 - 1991-Similar to Cantu, however, more strict
- American Academy of Neurology
 - 1997-Also graded system based on symptoms
- All graded on duration of symptoms +/- LOC and differentiated on number of concussions

11 **Some History**

- Vienna
 - 2001-International symposium structured to help address the topic of Concussion in Sport.
 - Provided new attempt to define concussion
 - Did not definitively address the grading scales
 - Did establish "individual treatment" paradigm
- Prague
 - 2004-Made differentiation of pediatric brain
 - Provided "Simple" & "Complex" grading system
 - Developed SCAT assessment tool
- Zurich
 - 2008-Most current consensus
 - No more simple vs complex, just concussion
 - Neuropsych testing

12 **Symptoms of Concussion**

- Cognitive
 - Confusion, amnesia, "unaware", irritability, "fogginess", poor concentration
- Physical
 - HA, unbalanced, nausea, visual problems, seizure-like activities, slurred speech
- Behavioral
 - inappropriate emotions (personality changes), depression

13 **On-Field Management**

- Evaluate the c-spine
 - If suspicious, immobilize and transport
- Needs to be seen by healthcare provider
- Assess the injury: SCAT 2 or similar
- Do not leave the player alone
 - They need serial monitoring
- Player should not be allowed to return on same day as injury occurred.

14 **On-Field Management**

- Complete neuro. exam
 - Include motor, sensory, balance
 - If focal deficits exist, neuroimaging should be strongly considered.
- Cognitive evaluation is essential
 - Include test of memory and concentration
 - Several tools exist to test on sideline
- Serial exams should be performed to monitor for deterioration of condition
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17 **Reasons to Transport off Field**

- Suspected C-spine injury
- Focal neurological deficit

- Athlete does not regain consciousness
- Condition deteriorates instead of improving
- If transporting to ED, should immobilize C-spine and place on backboard

18 **Concussion Investigation**

- Neuroimaging
 - Standard imaging is negative in concussion
 - Able to find other manifestations of TBI, including subdural, epidural, or subarachnoid hemorrhage
 - Newer techniques show promise
 - Still in early stages
 - fMRI most tested, seems to correlate well with specific activation patterns and severity of injury
 - Expensive, and may require baseline testing
 - Other options: PET, diffusion tensor imaging, MR spectrography, functional connectivity

19 **Concussion Investigation**

20 **Concussion Investigation**

- Objective Balance Testing
 - Force plate testing, or clinical balance testing
 - BESS (Balance Error Scoring System)
 - Video available at www.NCAA.org

21 **Concussion Investigation**

- Neuropsychological Testing
 - Clinical value in concussion evaluation
 - Helps to assess cognitive function
 - Useful in cases when unsure if cognition and clinical symptoms are progressing in sync
 - Should NOT be the sole basis for concussion management; only adjunct
 - RTP decision should be multidisciplinary if at all possible
 - Majority of NP testing done when symptom free

22 **Concussion Investigation**

- Experimental Assessment Modalities
 - Genetic Testing
 - Not clear based on research
 - Evoked Response Potential (ERP)
 - Cortical Magnetic Stimulation
 - EEG
 - Some promising data, but clinical significance not established

23 **Management**

- Physical and Cognitive rest until symptoms resolve
- Majority resolve in days
- Most proceed through stepwise RTP
- Rarely is any other intervention needed other than above

24 **RTP Protocol**

- Stepwise process where athlete progresses based on symptoms
 - Each step generally takes 24 hours
 - Advance as long as asymptomatic
 - If symptoms occur, return to previous asymptomatic step
 - More conservative approach may be necessary in pediatric population

25 **RTP Protocol**

- Steps
 - No Activity

- Light Aerobic Exercise
- Sport-specific Exercise
- Non-contact Training Drills
- Full Contact Practice
- Return to Play

26  **RTP Protocol**

- Same Day RTP
 - For ADULTS ONLY
 - Should still follow principles of clinical and cognitive recovery
 - Generally reserved for athletes/teams with sufficient resources
 - Pediatric elite athlete ≠ adult athlete

27  **Management**

- Pre-participation Evaluation
 - History is key
 - Previous head, face or c-spine injuries
 - Any history of affective disorder/issues
 - History of migraine
 - History of learning disability
 - Questioning is important, because many don't realize they've had these issues

28  **Modifying Factors**

- Can influence the investigation and management
- NP testing, balance testing and neuroimaging may play a larger role in concussion evaluation and management

29  **Modifying Factors**


- Symptoms
 - Number, duration, severity
- Signs
 - Prolonged LOC
- Sequelae
 - Convulsions
- Temporal
 - Frequency, timing, recency

30  **Modifying Factors**








- Threshold
 - Repeated concussions occurring with less force
- Age
- Comorbidities/pre-existing conditions
- Medications
- Behavior
- Sport
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31  **Special Populations**

- Pediatric
 - Zurich applies to children as young as 10
 - Cognitive testing must be age appropriate
 - Recovery may take longer than adults
 - Require more conservative RTP protocol
 - Should never RTP same day
 - Concussion modifiers apply more to kids

32  **Special Populations**

- Affective Disorders
 - Monitor closely for changes in symptoms, esp. suicidal ideation

- Medications may need to be adjusted
- ADHD
 - Recovery time generally longer
 - RTP protocol can be followed
 - Medications may need to be adjusted
- Chronic TBI (multiple concussions)
 - No consensus on effect of later cognitive deficit
- 33  **Injury Prevention**
 - Equipment
 - No good clinical evidence saying equipment will prevent concussion
 - Rule Changes
 - Risk Compensation
 - Added protective equipment may cause riskier behavior, therefore increasing risk of concussion
 - Aggression vs. Violence
- 34  **Medical Legal Issues**
 - The Zurich Consensus Statement was “not intended as a standard of care and should not be interpreted as such.”
 - “Individual treatment will depend on the facts and circumstances specific to each individual case.”
- 35  **Second-Impact Syndrome**
 - Rapid swelling of the brain with herniation
 - Occurs after second head injury while still recovering from the primary injury
 - Second impact may be mild (minimal contact, not necessarily to the head)
 - Loss of autoregulation of cerebral vasculature thought to be cause
- 36  **Postconcussive Syndrome**
 - “A syndrome that occurs as a result of a concussion, with its own distinct psychological pathophysiology. Symptoms can be physical, cognitive, mood or sleep related and are typically out of proportion to the inciting injury.”
 - Dr. Jeffery Kutcher, Lecture AMSSM, Cancun 2010
- 37  **Postconcussive Syndrome**
 - Persistent concussive symptoms for an extended period of time
 - Difficult to define
 - May relate to neurotransmitter dysfunction
 - May correlate with posttraumatic amnesia
 - Neuroimaging and NP testing should be considered in prolonged cases
 - Other treatment modalities may be needed other than physical and cognitive rest
- 38  **Medical Therapy**
 - Sleep (along with sleep hygiene)
 - Trazadone
 - Zolpidem
 - Nortriptyline
 - Physical
 - Anti-depressants: same for mood
 - Anti-epileptics
 - » Gabapentin
 - » Pregabalin
 - » Topiramate
- 39  **Medical Therapy**
 - Cognitive (along with cognitive rehab, school adjustments)
 - Amantadine
 - Donepezil

- Adderall
- Lisdexamfetamine
- Mood (along with psych. and cognitive tx)
 - Tricyclics (nortriptyline)
 - SSRIs (citalopram, sertraline)
- Important to be positive and try multiple modalities
 - Medications should typically be last on the list
 - Very little evidence on medical use in PCS

40  **Concussion Law**

- Effective August 1, 2011
- Applies to all athletes participating under UIL, TAPPS, or any other school district, public school, or private school
- Parents/Guardians required to sign concussion acknowledgement form regarding concussion prevention, symptoms, treatment and management
- Establishes Concussion Management Teams

41  **Concussion Law**

- Concussion Management Team
 - Must include at least one physician
 - Athletic trainer or neuropsychologist as well
 - May also include physician assistants or an advanced practice nurse
 - Member of the team must sign off that the athlete has completed the RTP protocol
 - Members must complete approved continuing education on concussions every 2 years

42  **Concussion Law**

- Athlete suspected of concussion may be removed by a coach, athletic trainer, parent/guardian, physician, or other healthcare provider
- Must not participate for at least 24 hours if suspected of having concussion
- All athletes must be seen by a physician who must sign a statement stating, in their opinion, it is safe to RTP

43  **Concussion Law**

- Student and parent/guardian must sign that they were made aware of the diagnosis, participated in RTP, and understand the risks associated with returning to sport
- Each school district is responsible for enforcement

44  **Questions?**

45  **References**

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