





"People have asked me how many concussion I've had," Favre said, "and I say, I don't remember"

OBJECTIVES

- Understand new issues in concussion diagnosis and management
- Manage post concussion symptoms
- Determine safe return to play
- Future Considerations







Spectrum of Concern

- Mental Health
- Concussion
- PPE
- ACL Prevention
- Sudden Death
- OMM
- ACL RTP
- Shoulder Instability
- Medical Illness
- Nutrition/ Supplements
- Navigating Training Room

- Regenerative Injections
- Fitness Injuries
- Overuse/Burnout
- Posture/Athletic Position
- Stress Fractures
- Facial Injuries
- Event Preparedness
- Return to Play
- MSK Ultrasound
- Female Issues
- Sideline Management















Learning Objectives

Epidemiology & Statistics of Concussions

- New NFL, NHL, MLS Guidelines & Legal Battles
- Anatomy & Mechanism of a CNS injury
- Evaluation & treatment of the athlete
- Current Concussion Grading Scales
- Return to Play guidelines
- Post Concussion Syndrome & Treatments
- Future Modifications

Sentinel Issues

- More Concussions than we know about
- Physician must see and recognize the event
- Children and female complications
- Multiple concussions have consequences
- Early RTP can be catastrophic
- Long term deficits can result from repetitive non concussive head injury
- No equipment/treatments have been proven efficacious
- Sub Threshold Exercise is essential
- Sleep
- VOMS



Journal of Pediatrics ER Concussion Study August 2010

 □
 14-19 yoa 3x
 7,000-22,000
 1997-2007

 □
 8-13 yoa 2x
 3800-8,000
 1997-2007

3 million Pre- high school participants

- □ 1.5 million high school participants
- 64,000 NCAA
- 600 NHL Players 4 Billion\$/year
- 1592 Pro Football Players 11 Billion\$/year

Concussion

- 84% back in one week 2% >month
- 75% contact with other player
- 5% LOC
- 95% Headache after
- 35% Headache before concussion

Statistics

- Football head injuries are TWICE as frequent as neck injuries.
- Where do most concussions occur during football
 - 43% Making the tackle D Secondary
 - 23% Being tackled Kick Unit
 - 20% Blocking
- Running Back
- 10% Being Blocked
- Linebackers

High School Stats

Football: 64 -76.8 Boys' ice hockey: 54 Girl's soccer: 33 Boys' lacrosse: 40 - 46.6 Girls' lacrosse: 31 - 35 Boys' soccer: 19 - 19.2 Boys' wrestling: 22 - 23.9 Girls' basketball: 18.6 - 21 Girls' softball: 16 - 16.3 Boys' basketball: 16 - 21.2 Girls' field hockey: 22 - 24.9 Cheerleading: 11.5 to 14 Girls' volleyball: 6 - 8.6 Boys' baseball: Between 4.6 - 5 Girls' gymnastics: 7

Evaluation of An Unconscious Athlete

- "An unconscious athlete cannot tell you his neck is broken"
- Always prepare for the worst!!
 - Access to Emergency Personnel
 - CPR trained personnel
 - Oral airways
 - Equipment for neck immobilization and transfer
- □ Stabilize neck, monitor airway, & transport



Frequently Observed Features of Concussion

• Symptoms:

- Headache (94%)
- dazed feeling
- Dinged
- Woozy
- Foggy
- Feel "not right"
- Bell ringing
- blurry vision, diplopia
- nausea- with vomiting and stupor/sub-dural

Frequently Observed Features of Concussion

Signs:

- Vacant stare- "lights on, but nobody home"
- Delayed verbal & motor responses
- Confusion & inability to focus attention
- Disorientation
- Ataxia
- Emotional Lability
- Slurred or incoherent speech
- Perseveration
- Detachment from game, asocial, withdrawn

Pathophysiology of Concussion

- CNS is NOT capable of axonal regeneration and repair like PNS.
- No gross structural changes in brain, but can see the following histological changes after a concussion
 - Interstitial Edema
 - Petechial hemorrhages
 - Micro-infarcts
 - Axonal shearing
 - Tau Proteins on Histology

Loss of Consciousness

- 1st Pivotal event in concussion grading
- Difficulty in definition-most define LOC *as a flaccid paralysis in an athlete unresponsive to verbal and motor stimuli*
- Described as momentary, brief, transient, seconds or minutes
- Seizure activity not unusual

Early Symptoms (Minutes to Hours)

Headache

- Amnesia or memory loss
- Visual disturbances
- Dizziness or Vertigo
- Nausea or Vomiting
- Confusion
- Balance (Ataxia)



Late Symptoms (Days to Weeks)

- Persistent low grade headache
- Lightheadedness
- Poor attention & concentration
- Memory dysfunction
- Easy fatigability
- □ Irritability & Low frustration tolerance
- Light Sensitivity
- Sleep Disturbance
- Anxiety/Depression

Physical Exam

- General appearance
- Visual Acuity, Pupils, Funduscopic Exam
- Facial muscles
- Cervical Spine AROM
- Balance
- Memory
- Reaction time
- GOOD NEUROLOGIC EXAM!

Sideline Evaluation

- Mental Status Exam
 - Orientation:
 - Time, Place, Person, Situation
 - Concentration:
 - Twelve fruits/vegetables
 - Months backwards (Dec, Nov, Oct,...)
 - Memory:
 - Names of prior teams
 - Recall 3 words & 3 objects
 - Details of the game (plays, score, etc)

Sideline Evaluation of Concussion

- Subjective symptoms
- Orientation & Concentration
- Memory: immediate, recent, remote
- Reaction time
- Amnesia: retrograde and antegrade
- Physical/Neurologic exam
- Cognitive Ability
- Provocative maneuvers





VOMS Testing

- Smooth Pursuits
- Horizontal Saccades
- Vertical Saccades
- Convergence
- VOR Test
- Visual Motion Sensitivity



Memory Exam

- Immediate
 - number recall, repeat sentences
- Recent
 - score, quarter, opponent, pre-game meal
- Remote
 - mother's maiden name, place of birth, name of grade school

Post Traumatic Amnesia

- Retrograde-before the event
 - Did we win last week? Who did we play? What play did we score on?
- Antegrade-after the event
 - State, river, color. Who brought you off the field? What quarter are we in?
- **•** Termination of PTA is reacquisition of continuous memory

Antegrade Memory Loss Questions

- "I want you to remember the state of Nevada, the river Snake, and the color purple."
- "Come and find me with 2 minutes left in the half."

Cognitive Exam Questions

- "What is the square root of 81?"
- "Name 10 fruits?"
- "Tell me the months of the year in reverse order starting with today's month?"
- "If pencils are 3 for a nickel, how many can you buy for 15 cents?"
- Spell "WORLD" Backwards





Zurich Guidelines 2008, 2012

- NP Testing, Biomarkers, fMRI
- Gender Women>Men Chronicity
- Elite vs Non Elite Athletes
- Pediatric <15
- SCAT 3
- Depression

- AMSSM Consensus Statement 2013
- Berlin 2018
- AMSSM Consensus Statement 2018

Initial Management of Concussion

- Be aware of differences in guidelines for LOC
- □ If transported to ER, CT scanning & observation
- If no LOC, observe closely on sideline or locker room (Non distracting environment)
- Re-exam within one hour; if PTA still present strong consideration for CT
- FOLLOW UP care arranged before athlete leaves locker room

Field Management

Symptoms < 15-20 minutes</p>

- Remove from contest (take helmet)
- Examine immediately & q 5 minutes for development of mental status abnormalities or post-concussive symptoms at rest or exertion Memory, Balance, Weakness, Pain, Reaction Time, History
- May return to play if mental status abnormalities & clear w/in 15 minutes.

Field Management

- □ Symptoms >15-20 minutes
- Remove from play & not allow return that day.
 - Examine on-site frequently for signs of evolving intra-cranial pathology.
 - A trained person (MD, DO, ATC) should re-examine the athlete the following day
 - A physician should perform a Neurologic Examination to clear the athlete for RTP after 1 full asymptomatic week at rest & exertion.

Criteria for Removal From Game

- An athlete should be removed from competition that day if there is:
 - any LOC
 - PTA
 - continuing symptoms
 - cognitive dysfunction
 - exacerbation of symptoms with exercise

Post Concussion Syndrome Definition: Athletes with persistent sleep disturbance, somatic, emotional, and cognitive symptoms past 24-48 hours and no evidence for

- structural injury are said to be suffering from post concussion syndrome
- Most athletes with PCS recover in 5 days with some persisting up to 3 weeks to 3 months and a small percentage as long as one year
- Females and under 15 YOA

Psychological Testing

- □ Can be useful 'adjunct' to evaluate athletes with Concussion
- Baseline Testing during PPE
- PHQ-9 GAD 7

 Most common parameters affected are memory and reaction time coupled with information processing

Complex Concussion

- Cognitive/Fatigue
- Vestibular
- Oculomotor
- Affective
- Migrainous
- Cervical Spine







	Difficulties brining eyes together/using eyes in		
Ocular	tandem Difficulty tracking motion		
Post-Traumatic Migraine	Headaches Nausea	35%-95%	
Cervical	Light sensitivity Headaches		
	Neck pain/dysfunction Dizziness		

	Excessive worry		
Anxiety/Mood	Difficulty turning thoughts off		
	Personality changes		
Physiological	Symptoms exacerbated by exercise/increased cognitive function (headache, dizziness, nausea, fatigue, difficulty concentrating)	Difficulty Sleeping	





RTP per Physician

- Diagnostics CT/MRI
- NeuroPysch Testing SAC, SCAT 3, Computer Balance Testing

- School Work

- Appetite

- Exertion Testing/Graded Aerobic Protocol
- Enthusiasm to Return
- ATC/ Coaches Opinion
- Age/Gender/Tanner /Sport/ PositionParents Expectations
- Prevention Counseling
- Equipment / helmet fit / mouthgard
- EDUCATION
- Strength and Fitness

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Common Sense (is not common)

- Times when it is not advisable to return an athlete to competition who has suffered a head trauma but with no evidence of concussion
 - the very young and female
 - a second "ding" in a contest
 - recent concussion
 - *reluctance to participate*

Condition Mimicking Concussion

- Heat Exhaustion and Heat Stroke
- Dehydration
- Medication
- Weight lifters headache
- Hypoglycemia

- Migraine
- **•** First week of contact football
- **Soccer Heading**
- Altitude sickness









34

Head Trauma

- Leaking Capillaries
- Inflamed Astrocytes
- Changes in electrical function
- Decreased Cognition
- Independent of Concussion







Sleep Rest and Recovery

- Sleep Loss Impairs:
- Immune Functioning
- Memory Functioning
- Mood Regulation
- Hand-Eye Coordination
- Attention Concentration

- Driving a Motor Vehicle
- 🗉 Libido

Parasympathetics

Lower Arousal- Meditation, Mindfulness, Breathing



10 Cs of CONCUSSION

- Concealment
- Capitulation
- Circumstance
- Complicity
- Convenience
- Collusion
- Competence
- Conflictual
- Class Action
- Celebrity

- CTE
- Mental Health
- Violent Behavior
- Depression
- Abuse
- Disability





Retiring an Athlete

- Sometimes straightforward, but usually complicated
- No evidence based approach is currently available
- AMSSM position statement suggests considering the following:
 - Number of concussions
 - Decreased concussion threshold
 - Prolonged recovery
 - Structural abnormality
 - Persistent diminished brain function
- May fully disqualify athlete (ie; no competitive sports) o partially disqualify athlete (ie: no contact sports)