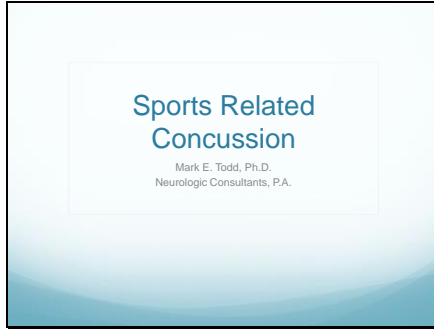
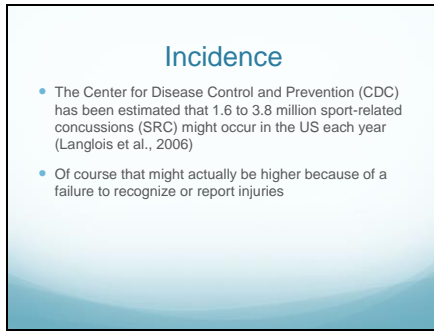


Slide 1



Slide 2



Slide 3

Incidence

- The majority of concussions in organized sports in the US occur in football, wrestling, girls' soccer, boys' soccer, girls' lacrosse, boys' lacrosse, and girls' basketball
- More concussions occur during competition as compared to practice
- Female athletes are more likely to sustain a concussion in high school and college sports with the same rules

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Incidence

- The reported incidence is expected to increase with greater focus on concussion awareness and state legislation

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Concussion Defined

- Concussion is a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process
- Loss of consciousness occurs about 10% of the time
- Concussion is a subset of Mild Traumatic Brain Injury (mTBI)
- It is more self-limited and at the less severe end of the brain injury spectrum

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Signs and Symptoms

- Physical: Headache, nausea, vomiting, balance problems, dizziness, visual problems, fatigue, sensitivity to light, sensitivity to noise, numbness, dazed, stunned
- Cognitive: Feeling "foggy," slow, difficulty concentrating, poor memory, confusion, problem learning
- Emotional: irritable, sad, nervous, labile
- Sleep: more or less than usual, tired, poor quality

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Pathophysiology

- Linear and/or rotational forces are transmitted to the brain
- No known biomechanical threshold
- Neurometabolic cascade: ionic, metabolic, and pathophysiological events as well as microscopic axonal injury

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Susceptibility to 2nd Injury

- With a concussion, increased energy is required to re-establish homeostasis for ionic balance and normal metabolism
- However, with concussion, there is ongoing mitochondrial dysfunction and decreased cerebral blood flow
- As a result, studies show an increased postconcussive vulnerability

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2nd Injury and Recovery

- The concussed brain is less responsive to physiological neural activation
- Cognitive and/or physical stimulation before full recovery may result in prolonged dysfunction
- Immature brains may be more susceptible to this process

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Recovery

- Most studies show that 80-90% of athletes will have symptom resolution in the 7 days following a concussion

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Prolonged Recovery

- Post-concussive Syndrome
 - Where does concussion end and post-concussion syndrome (PCS) start?
 - Risk factors: age (very young or older), gender (females more likely), and non-sports related injuries
 - Co-morbidity with mood disorders, sleep disorders, and/or substance abuse

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Risk Factors for SRC

- Previous concussion: 2 to 5.8 higher risk
- Greater number, severity, or duration of symptoms are predictors of prolonged recovery
- Dizziness at the time of injury tends to predict a longer recovery
- Females more likely to sustain a concussion (perhaps related to decreased head-neck segment mass or estrogen and differences in cerebral blood flow)

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Cont'd Risk Factors

- Younger athletes may be susceptible to injury, especially catastrophic events
- Mood disorders (pre-existing or as a result of SRC?)
- Learning Disabilities/Attentional Disorders
- Migraine

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Management of SRC

Baseline/Pre-season examination:

- History of concussion
- Presence of mood, learning, or attention conditions
- History of migraine
- Cognitive assessment (ex: ImPACT)
- Debatable benefit as no study has shown that baseline studies improve outcome

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Management Cont'd

- On-Field Management: airway, breathing, and heart function; exclude cervical spinal and/or more serious TBI
- Sideline Assessment: (ex: SCAT-2) history of injury, immediate symptoms, and focus especially on balance
- Follow-up Evaluation and Treatment: Symptom management (headache, balance problems, dizziness, vestibular symptoms)

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Neuropsychological Assessment

- Standardized Testing
- Assessment of cognitive and psychological factors relevant to concussion
- Areas assessed
 - Mood and emotion
 - Learning and memory
 - Attention
 - Speed of Processing
 - Executive Functioning

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Return to Play

- Athletes should be symptom free, at rest and with exertion
- Normal exams (neurologic and neuropsychologic)
- Graduated return to play protocol: increasing physical activity as tolerated
- Individual factors (ex: anxiety, prior history, migraine)
- Team Factors

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Chronic Traumatic Encephalopathy (CTE)

- Definition: neurodegenerative disease associated with repetitive brain trauma, and characterized by accumulation of tau protein
- This is a post-mortem diagnosis
- This is not a continuation of post concussive syndrome but manifests much later after injury
- Not all athletes with CTE reported a history of concussion

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CTE cont'd

- There is little question that a Traumatic Brain Injury leads to pathological changes associated with degenerative dementia (amyloid and tau)
- The greater question is what level of injury is required to develop CTE?
 - Reliability of CTE diagnosis
 - Genetic variables
 - Other confounding variables

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Prevention

- Rules of the game
- Restricting exposure? Limiting practice
- Player behavior
- Player equipment
- Neck strengthening

Legislation

- Education of athletes, coaches, parents and school/organizational officials
- Removal of any athlete who is suspected of having sustained a concussion
- Return to play only after evaluated and cleared by an appropriate healthcare professional
