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Concussions in Youth Athletes

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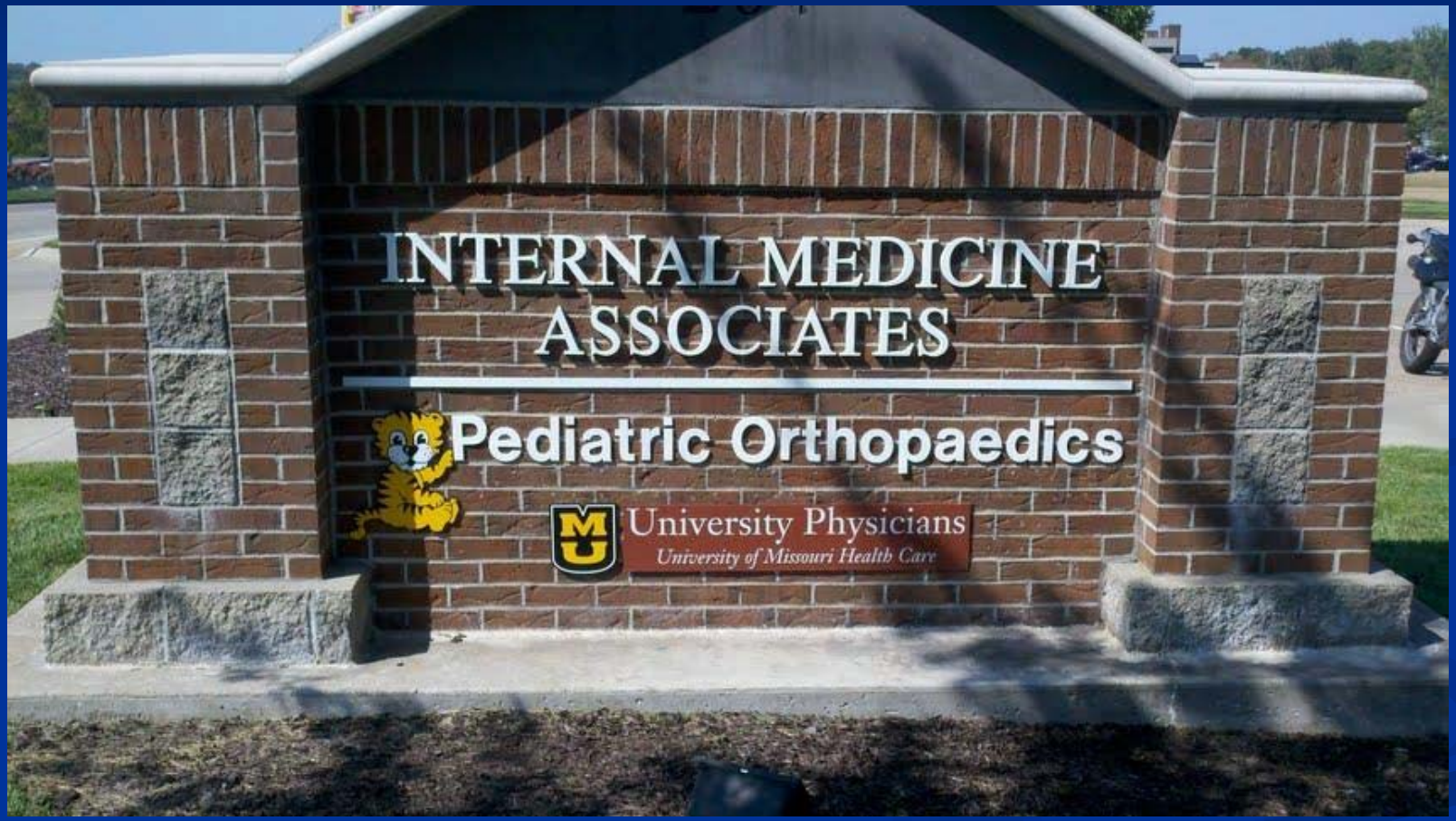
For Appointments: 882-BONE (2663)

Pediatric Orthopaedics



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Overview

- Definition
- Epidemiology
- Pathophysiology
- Diagnosis
- Return to Play

Definition

- Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.

3rd International Conference on Concussion in Sport (Zurich, 2008)
McCrory, et al 2009 Clin J Sport Med 2009; 19:185-200

Features of Concussion

- Direct blow to head or elsewhere on the body with an “impulsive force transmitted to the head”
- Rapid onset of short lived impairment of neurologic function that resolves spontaneously

3rd International Conference on Concussion in Sport (Zurich, 2008)
McCrory, et al 2009 Clin J Sport Med 2009; 19:185-200

Definition

- May result in neuropathologic changes, but the acute clinical symptoms largely reflect a **functional disturbance rather than a structural injury**
- May or may not include loss of consciousness
- No abnormality is seen on standard CT scan or MRI

3rd International Conference on Concussion in Sport (Zurich, 2008)
McCrory, et al 2009 Clin J Sport Med 2009; 19:185-200

Epidemiology

- Estimated 207,000 emergency room visits per year for sports related traumatic brain injury (TBI).
  - Children age 5-18 account for 65% of these visits.

Centers for Disease Control *MMWR*. 2007; 56;733-7

- 1.6-3.8 million estimated sports related TBIs occur each year
  - Many do not seek care or are not treated by a physician

Langlois J. J Head Trauma Rehab 2006.

Epidemiology

- Of 144,000 emergency room visits for concussions
  - 42% ages 5-14
  - 40% ages 15-19
  - Sports related in 30%

Meehan, Mannix. *J Pediatr,* 2010.

- Concussions 5.5% of all high school sports injuries

Powell, Barber-Foss. *JAMA*, 1999.

Epidemiology

- High School Sports Concussions
  - Football 40.5%
  - Girls' soccer 21.5%
  - Boys' soccer 15.4%
  - Girls' basketball 9.5%

Gessel et al. *J Athl Train*, 2007.

Epidemiology

- High School
  - Estimated 136,000 concussions per academic year
- 544 concussions recorded in online surveillance system during 2008-2009
  - 57% involved in football
  - 84% resolution of symptoms in 1 week
  - 94% experienced headache
  - 24% had amnesia
  - 4.6% lost consciousness

Meehan et al AJSM PreView, published online Aug. 17, 2010

Epidemiology

- During 1999-2001 seasons NCAA football players were followed for total of 2410 player seasons
  - 3.9% suffered concussion

McCrea, Guskiewicz, Marshall *et al* JAMA 2003: 290: 2556-63.

Epidemiology

- Rates by sport (percentage of total injuries that were concussion in NCAA sports during 2002-2003)
  - 12.2% ice hockey
  - 8% football
  - 5% soccer

McCrea, Guskiewicz, Marshall *et al* JAMA 2003: 290: 2556-63.

Concussion Rates by Football Position per 1000 Athlete Exposures

1. Linebacker 0.99
2. Offensive Lineman 0.95
3. Defensive Back 0.88
4. Quarterback 0.83
5. Special Teams 0.77
6. Defensive Lineman 0.76
7. Running Back 0.71
8. Receiver 0.54

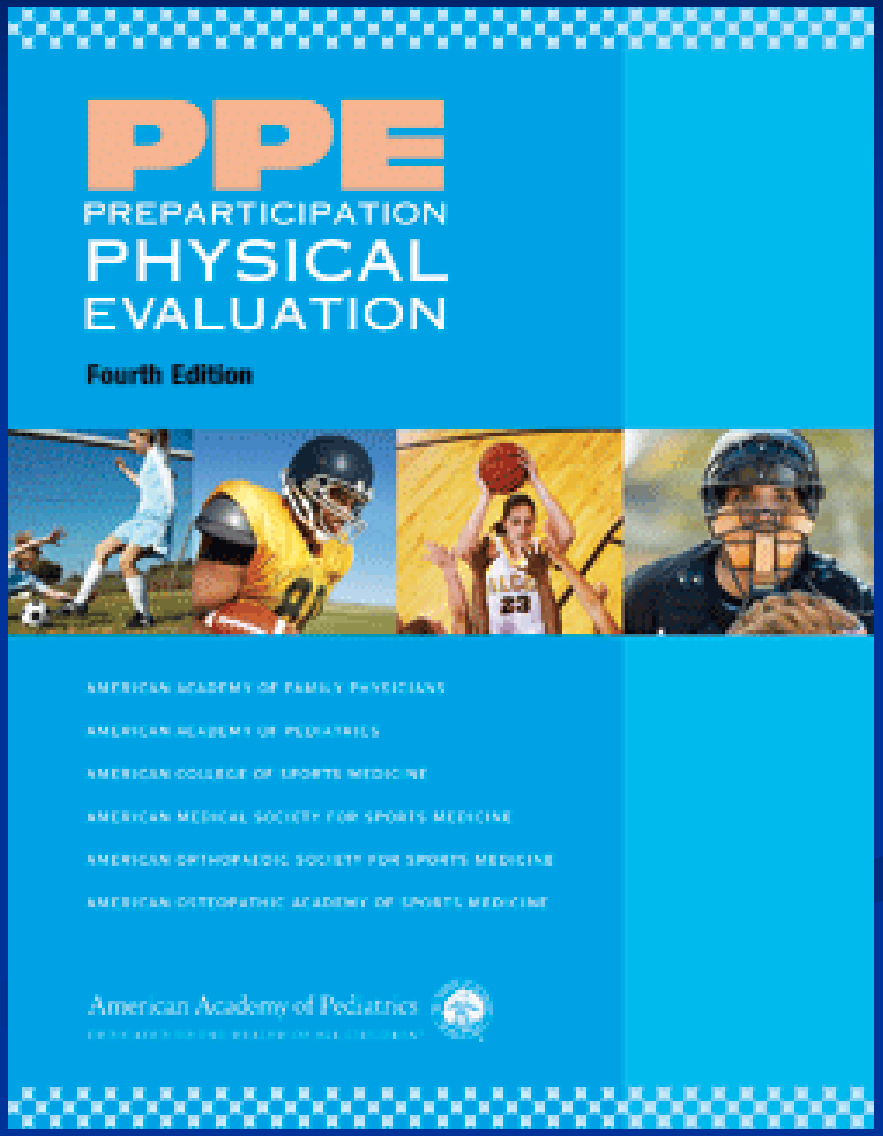
Guskiewicz, *JAMA* 2003

Concussion Management

- Three aspects of management
  - Starts with the pre-participation physical exam
  - Sideline assessment
  - Return to play decisions

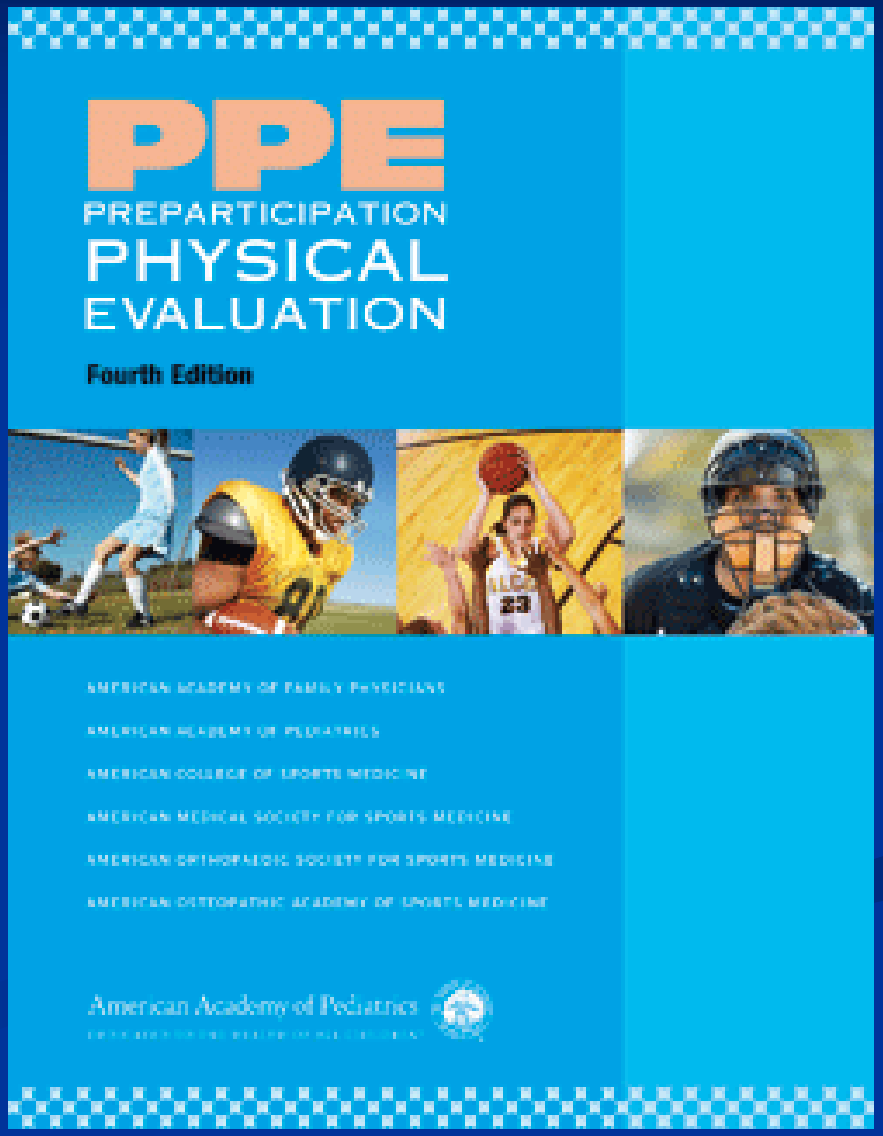
Preparticipation Evaluation

- Have you ever had a head injury or concussion?
- Have you ever had a hit or blow to the head that caused confusion, prolonged headache, or memory problems?
- Do you have a history of seizure disorder?



Preparticipation Evaluation

- Do you have headaches with exercise?
- Do you have frequent or severe headaches?
- Have you had a facial or dental injury from sports?



Preparticipation Evaluation

- Further questions to ask if positive history of concussion
  - Number of previous concussions
  - History of LOC or amnesia
  - Recovery time
  - Attention disorders, learning disabilities

Mark Zaleski / The Press-Enterprise

On Field & Sideline Evaluation

- Symptoms may be delayed
- Exercise high suspicion because athletes often will deny symptoms

On Field Evaluation

- Check A,B,C's
- Assume C-Spine injury if athlete is unconscious
- Check Cervical Spine
  - Symptoms of neck pain
  - Symptoms of numbness or weakness in extremities
  - Palpation
  - ROM of cervical spine if above is normal
  - Extremity strength

Diagnosis

- Concussion should be suspected in the presence of any one or more of the following:
  - Symptoms (headache, etc.)
  - Physical signs (unsteadiness, etc.)
  - Impaired brain function (e.g. confusion)
  - Abnormal behavior

Concussion Symptoms

Concussion Symptoms

Concussion should be suspected in the presence of **any one or more** of the following:

- Loss of consciousness
- Seizure or convulsion
- Amnesia
- Headache
- "Pressure in head"
- Neck pain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance Problems
- Fatigue or low energy

Concussion Symptoms

- Sensitivity to noise or light
- Feeling slowed down
- Feeling “in a fog”
- Difficulty concentrating
- Difficulty remembering
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious

Percentage of Players with Concussion Reporting Moderate to Severe Symptoms at Time of Injury

- Headache 85%
- Dizziness/balance difficulties 77%
- “Slowed Down” 69%
- Decreased Concentration 60%
- Sensitivity to Noise or Light 60%
- Fatigue 55%
- Memory Problems 45%

Guskiewicz, McCrea, et al. JAMA 2003; 290:2549-2555

Physical Signs

- Loss of consciousness
  - If so, how long?
- Examination
  - Glasgow coma scale (GCS)
  - Dental exam
  - Cranial nerves
  - Strength of extremities
- Balance problems/unsteadiness

Impaired Brain Function

- Sideline Assessment – Maddocks Score
  - What venue are we at today?
  - What half is it now?
  - Who scored last in the game?
  - What team did you play last week/game?
  - Did your team win the last game?
- 1 point for each correct answer

Balance Error Scoring System

- Modified BESS is used in the SCAT2
- Eyes are closed with hands on hips in different positions for 20 seconds
  - Narrow double leg stance
  - Single leg stance
  - Tandem stance

Balance Error Scoring System

Now that a Concussion is Suspected…

- Remove from practice/game
  - Take the helmet or other required equipment
  - Monitor for deterioration
    - Seizures
    - Impaired consciousness
    - Focal neurologic signs
    - Vomiting or worsening of headache
    - Increasing confusion or slurring of speech
  - If these occur get athlete to ER ASAP!

Recurrent Concussions

- In a prospective cohort study of 4251 player seasons, 6.3% NCAA football players had a concussion
  - 6.5% of these players had a repeat concussion the same season
- Players reporting a history of ≥3 concussions were 3x more likely to suffer a concussion than those with no history

Guskiewicz K et al. *JAMA* 2003, 290: 2549-2555

Recurrent Concussions

- 30% of those with history of ≥3 concussions had symptoms >1 week compared to 14.6% to those with 1 previous concussion
- 11/12 who suffered a same season concussion occurred with 10 days of first injury
  - 9/12 occurred within first 7 days

Guskiewicz K et al. *JAMA* 2003, 290: 2549-2555

Second Impact Syndrome

- First described by Saunders and Harbaugh in 1984
  - Requires a second impact while an athlete is recovering from an initial concussion
  - Can result in rapid cerebral edema, brainstem herniation, and death
  - Thought to result from a loss of autoregulation of cerebral vasculature
  - Characterized by a precipitous collapse, rapidly dilating pupils, coma, and respiratory failure

Second Impact Syndrome

- There is now controversy if this syndrome even exists
  - McCrory suggests, “Rather than SIS being a complication of recurrent concussion, it is far more likely that the clinical condition represents “diffuse cerebral swelling,” a well-recognized complication of traumatic brain injury”

McCrory, Clin J Sport Med. 2001 Jul;11(3):144-9

Special Considerations for Children

- A child's brain is still developing in multiple ways
- Children take longer to recover than older adolescents and adults
- Recovery patterns have not been studied well in children <15 years old
- Recommend to hold out of activity until asymptomatic for a few days

Special Considerations for Children

- Counsel on activities that can worsen symptoms
  - Physical activity
  - Computer and video games
  - Television
  - Texting
  - Reading
  - School related activities

Special Considerations for Children

- 90% of college athletes recover within 7 days but only 50% of high school athletes had completely symptom free at 7 days

McCrea et al. *JAMA* 2003.

- Cognitive rest
  - Communication with teachers & school

Determining Return to Play

- Involves 3 areas
  - Symptom assessment
  - Neurologic exam
  - Cognitive evaluation

Stepwise Return to Play

- Each stage should take at least 24 hours
- If symptoms return the patient should drop back to the previous level and rest for 24 hours before resuming progression
- Stage 1
  - No activity
  - Complete physical and mental rest until asymptomatic

Stepwise Return to Play

- Stage 2
  - Light aerobic exercise
  - Walking, swimming, stationary bike
- Stage 3
  - Sport specific exercise which adds movement
- Stage 4
  - Non-contact drills
  - May start resistance training
  - *Consider Neuropsych testing

Stepwise Return to Play

- Stage 5
  - Full contact practice
- Stage 6
  - Return to competition

Thanks!