SPORTS RELATED CONCUSSION

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Accreditation Information:
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OBJECTIVES

- Given a patient with a head injury, recognize signs and symptoms of a Sports Related Concussion
- Having identified a concussion, perform an office-based assessment of a Sports Related Concussion
- Understand treatment protocols for sports-related concussions
- Understand complicating factors in return-to-play

Financial Disclosure:
Rodolfo R. Navarro, MD, has no relevant financial relationship with commercial interests to disclose.

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WHY ARE CONCUSSIONS IMPORTANT?

EPIDEMIOLOGY

- Across all levels of sport:
  - 1.6 – 3.8 million SRC
    (including unreported cases)
- For 5 – 18 y/o from 2001 – 2005
  - 6% of 2.4 million sports-related
    ED visits
  - Approx. 28,800/yr or 80 per day!
- Estimates show that at least 50% of head injuries are not reported
EPIDEMIOLOGY

- For nine sports from 2005 to 2010 (100 US high schools)
- Estimated 732,805 concussions
  - About 146,561 per year
- 13.2% new concussions

WHY ARE CONCUSSIONS IMPORTANT?

WHAT IS A CONCUSSION?

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

WHAT IS A CONCUSSION?

- Rapid onset of short-lived neurologic impairment that resolves spontaneously
- Induces functional abnormalities
- With or without loss of consciousness
- Caused by a direct blow to or an impulsive force transmitted to the head

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WHAT IS NOT A CONCUSSION?
- Intra-cranial hemorrhages
- Cerebral or cortical contusions
- Diffuse Axonal Injury
- LOC >30 min
- Seizures (Epilepsy)
- Spinal Cord Injury
- Can occur WITH a concussion

PATHOPHYSIOLOGY
- Based on biomechanical data:
  - Concussive injury threshold is elusive and likely irrelevant
  - No association between impact biomechanics and post-concussive outcomes
  - Is mechanism of injury irrelevant?

PATHOPHYSIOLOGY
- Lack of structural damage
- Regional metabolic abnormalities occur:
  - Hyperglycolysis (regionally)
  - Decreased regional blood flow
  - Expression and hypersensitivity to excitatory neuropeptides

PATHOPHYSIOLOGY
- Biomechanical studies...
  - "Appears to be no association between impact biomechanics and post-concussive outcomes."
  - "Studies suggest that a concussive injury threshold is elusive and may, in fact, be irrelevant when predicting the clinical outcome."
  - "No protective equipment was found to prevent sport-related concussions convincingly."
  - If a biomechanical threshold cannot be calculated, then what is a clinically-relevant concussive force, in regards to long-term effects, ie. what is safe?
CLINICAL DIAGNOSIS & MANAGEMENT

DIAGNOSIS

- Diagnosis of a concussion is made clinically
  + i.e. Talk to the athlete...
- Usually requires input from parents, friends, coaches, teachers, athletic trainers, school nurse, etc
- Multiple tools available, many are not practical
- No single score/positive/negative finding will diagnose

TYPICAL SYMPTOMS

- Symptoms occur across multiple “domains”
  - Cognitive
  - Psychiatric/behavioral
  - Physical
- Symptoms typically follow a pattern
  - Physical, then cognitive/psychiatric
- Severity does not predict clinical outcome!
  - The symptom burden might....

TYPICAL SYMPTOMS

- Cognitive:
  - Slurred speech
  - Disorientation or Confusion
  - Amnesia
  - Slow response time
  - Poor concentration
  - Impaired short-term memory/learning
TYPICAL SYMPTOMS

**Psychiatric:**
- Irritability
- Personality changes
- Inappropriate emotions (eg, laughing, crying)
- Inappropriate playing behavior (eg, running the wrong direction)
- Significantly decreased playing ability

**Physical:**
- Headache/head pressure
- Dizziness**
- Nausea
- Visual problems (eg, Seeing stars or flashing lights, double vision)**
- Hearing problems (eg, ringing in the ears)
- Feeling “dinged”, “foggy”, “stunned,” “dazed”
- Poor coordination or balance**
- Seizure-like activity
- Gait unsteadiness**

***May be related to the vestibular dysfunction

DIAGNOSTIC TESTING

- Mental status and orientation
- Attention and memory (immediate and delayed recall)
- Concentration (Months of Year in Reverse, Digits-Backwards)
- Processing/calculating ability (Digits-Backwards, MOYR, Serial Sevens, Serial Threes, Spelling tests)
- Balance and cerebellar function (BESS, Finger-Nose Touch)
- Otherwise NORMAL neurologic exam
- No single score/positive/negative finding will decide

SIDELINE EVALUATION

Validated techniques are limited

- Maddocks’ questions (1995) – orientation, mental status
- Months of year in reverse order (high school validated)
- Balance Error Scoring System (BESS)
- Sport Concussion Assessment Tool 3

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**Orientation Evaluation: Maddock’s Questions**

- Which field are we at?
- Which team are we playing?
- Who is your opponent at present?
- Which quarter (half) is it?
- How far into the quarter (half) is it?
- Which team scored last?
- Which team did we play last week?
- Did we win last week?

**Balance Error Scoring System**

- Administered with/without foam block
- Eyes closed, hands on hips for all positions
- 20 seconds per pose
- Trials consist of double-, tandem-, and single-leg stances on two surfaces (firm and foam)
- Balance errors scored (i.e., stepping, stumbling, opening eyes, lifting hands from the iliac crest, lifting forefoot or heel, moving hip into more than 30 degrees of flexion or abduction, or remaining out of the test position for more than five seconds).
- After a concussion, athletes typically have at least 12 errors in this series of trials.

**Vestibular Testing**

- EO motions
- Accomodation
- Pursuits (Vert/Horiz)
- Saccades testing
- VOR testing (dolls-eyes)
- Kind-Devick Test

**Diagnosis Tools**

- Sports Concussion Assessment Tool (SCAT-3)
  + Designed more for sideline or same-day assessment
  + Not ideal for serial testing
  + Utilizes multiple assessments of symptoms, cognitive state, and neurologic function
- Sports Concussion Office Assessment Tool (SCOAT)
  + Designed for office-based use, “all-in-one” document
  + Designed for serial testing with use of modified scoring system, so ideal score is “0”
WARNING SIGNS

- Worsening symptoms, especially headache or drowsiness
- Repeated or uncontrolled vomiting
- Prolonged seizure-like activity
- Focal weakness or numbness of extremities
- If present, send for immediate evaluation
- Precautions:
  - Continued monitoring is important!
  - Never leave alone or allow to be alone!
CLINICAL PRESENTATION: COGNITIVE

- Impairment of:
  - New learning
  - Short-term memory
  - Attention
  - Speed of information processing
  - Visual-spatial abilities
  - Language
  - Sensorimotor function

COGNITIVE: MONTHS OF YEAR IN REVERSE

- Start in middle of year
- Validated in “normal” high school males – (testing serial 7s and 3s unreliable)

GLASGOW COMA SCALE

- GSC = Eye opening + verbal response + motor response
- GSC is most often nl in sports injuries
- GSC < 5 → 80% die or remain in vegetative state
- GSC > 11 → >90% complete recovery

<table>
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<th>EYE OPENING</th>
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<tr>
<td>Spontaneous</td>
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<tr>
<td>Verbal command</td>
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<tr>
<td>Painful stimuli</td>
<td>2</td>
</tr>
<tr>
<td>No eye opening</td>
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</tbody>
</table>

VERBAL RESPONSE

- Oriented and converses | 6
- Disoriented and converses | 4
- Inappropriate words | 3
- Incomprehensible sounds | 2
- No verbal response | 1

MOTOR

- Obeys verbal commands | 6
- Localizes pain | 5
- Withdraws from pain | 4
- Flexor posturing | 3
- Extensor posturing | 2
- No motor response | 1

MANAGEMENT

INITIAL MANAGEMENT

- Begin with the ABC's!
  + Rule out cervical spine injury
- Safely remove the athlete from play
- Re-assess for more urgent issues
- Evaluate for a concussion
- Monitor with serial exams
- Follow-up