Pre and Post Concussion Management
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Concussion

• A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces (McCrory P., Meeuwisse W., Johnston K., Dvorak J., Aubry M., Molloy M., & Cantu R., 2009)

Common Features

• Caused 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

Common Features

• Results in a graded set of clinical symptoms that may or may not involve the loss of consciousness

• No abnormality on standard structural neuroimaging studies seen in concussion
Concussion Evaluation

• Signs and Symptoms of Acute Concussion

• On-Field or Sideline Evaluation

• Evaluation in Emergency Department or Office

Signs and Symptoms

• Assess a range of domains
  – Clinical symptoms
  – Physical signs
  – Behavior
  – Balance
  – Sleep disturbances
  – Cognition

Clinical Symptoms

• Headache
• Dazed or dizzy
• Nausea and vomiting
• Blurred vision
• Ringing in ears
Physical Signs

• Loss of consciousness
  – Only 10% of all concussions involved a loss of consciousness

• Amnesia
  – Found in less that 30% of all concussions

Behavior Changes

• Irritable

• Restless

• Emotional lability

Sleep Disturbances and Cognition

• Sleep Disturbances
  – Drowsiness
  – Trouble sleeping

• Cognition
  – Slowed reaction times
On-Field or Sideline Evaluation

- Use standard emergency management principles
  - Particular attention should be given to rule out a cervical spine injury
- Evaluation should be performed by a healthcare provider
- Assessment of the concussive injury should be made using the Sport Concussion Assessment Tool 2 (SCAT2) or other similar tool

On-Field or Sideline Evaluation

- The player should not be left alone following the injury
- Serial monitoring for deterioration is essential over the initial few hours post injury
- A player with a diagnosed concussion should not be allowed to return to play on the day of injury

Pocket SCAT2

Concussions should be suspected in the presence of any one or more of the following symptoms: headache, vomiting, trouble remembering, trouble with balance, dizziness, blurred vision, difficulty concentrating, feeling “foggy,” feeling “drunk,” feeling “tired,” confusion, drowsiness, more emotional, irritability, sensitivity to noise, feeling slowed down, feeling like “a fog,” “Don’t feel right,” difficulty remembering, fatigue or low energy.

1. Symptoms
   - Presence of any of the following signs & symptoms may suggest a concussion
   - Loss of consciousness
   - Seizure or convulsion
   - Altered consciousness
   - Loss of memory
   - Trouble in head
   - Neck pain
   - Nausea or vomiting
   - Dizziness
   - Blurred vision
   - Balance problems
   - Slurred speech
   - Sensitivity to noise

2. Memory function
   - Suggest to answer all questions correctly may suggest a concussion
     - “Where were you 5 minutes ago?”
     - “What did you have last week?”
     - “What leaves you after last week?”
     - “Did you have a fall game?”

3. Balance testing
   - Instructions for tandem stance
     - Stand with your non-dominant foot in back, your weight should be evenly distributed across both feet. You should try to maintain stability for 30 seconds with your eyes open and your eyes closed.
     - I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing.

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY; urgently assessed medically should not be left alone and should not drive a motor vehicle.
On-Field or Sideline Evaluation

• Sideline evaluation of cognitive function is an essential component in the assessment
• Tests that assess attention and memory function have been shown to be practical and effective
  – Maddocks questions
  – Standardized Assessment of Concussions (SAC)
• Remember...the appearance of symptoms might be delayed several hours!!

Evaluation in Emergency Department or Office

• A medical assessment including a comprehensive history and detailed neurologic examination, including a thorough assessment of mental status, cognitive functioning, and gait and balance.
• A determination of the clinical status of the patient
  – Improvement or deterioration since the time of injury

Evaluation in Emergency Department or Office

• A determination of the need for emergent neuroimaging
  – Exclude a more severe brain injury
Classification of Concussions

• Glasgow Coma Scale
  – Because of decreased severity typically associated with sport-related concussion, this scale is rarely used for classifying head injuries that occur among athletes
• Cantu Evidence-Based (2001)
• Colorado Medical Society (1991)
• American Academy of Neurology (1997)
• University of North Carolina Classification of Cerebral Concussion (2001)

<table>
<thead>
<tr>
<th>Grade or Level</th>
<th>Cantu Evidence-Based</th>
<th>Colorado Medical Society</th>
<th>American Academy of Neurology</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No LOC; posttraumatic amnesia lasting less than 30 minutes or post concussion signs or symptoms lasting less than 24 hours</td>
<td>No LOC Confusion No amnesia Return to Play after 20 minutes with normal exam</td>
<td>Transient confusion No LOC Symptoms and mental status abnormalities resolve in less than 15 minutes</td>
</tr>
<tr>
<td>1</td>
<td>LOC lasting less than 1 minute or posttraumatic amnesia lasting 30 minutes to 24 hours or post concussion signs or symptoms lasting more than 24 hours but less than 7 days</td>
<td>No LOC Confusion Amnesia No return to play that day</td>
<td>Transient confusion No LOC Symptoms and mental status abnormalities last more than 15 minutes</td>
</tr>
<tr>
<td>2</td>
<td>LOC lasting more than 1 minute or posttraumatic amnesia lasting more than 24 hours; or post concussion signs or symptoms lasting more than 7 days</td>
<td>LOC Transport to emergency medical facility with full neck injury precautions Neurosurgical evaluation</td>
<td>Any LOC; brief (seconds) or prolonged (minutes)</td>
</tr>
</tbody>
</table>

UNC Classification of Cerebral Concussion

<table>
<thead>
<tr>
<th>Grade</th>
<th>LOC</th>
<th>Cranial Nerves, Cognition, and Coordination (3 Cs)</th>
<th>Headache</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (mild)</td>
<td>No LOC</td>
<td>Abnormal confusion but asymptomatic in 30 minutes; passes functional tests without recurrence of signs and symptoms</td>
<td>Possibly develops later</td>
</tr>
<tr>
<td>1 (mild)</td>
<td>No LOC</td>
<td>At least 1 of the following is present: 1. Abnormal cranial nerve functioning lasting &lt;1 hour 2. Abnormal cognition lasting &lt;1 hour 3. Abnormal coordination lasting &lt;3 days</td>
<td>Probable; lasts from 10 minutes to as long as 2 days</td>
</tr>
<tr>
<td>2 (moderate)</td>
<td>Brief LOC from 10 seconds to 1 minute or altered consciousness lasting &gt;2 minutes</td>
<td>At least 1 of the following is present: 1. Abnormal cranial nerve functioning lasting &gt;1 hour 2. Abnormal cognition lasting &gt;1 hour 3. Abnormal coordination lasting longer than 3 days</td>
<td>Probable; lasts 24 hours to 4 days</td>
</tr>
<tr>
<td>3 (severe)</td>
<td>LOC &gt; 1 minute or altered consciousness lasting &gt;2 minutes</td>
<td>2 of 3 Cs are abnormal for more than 24 hours</td>
<td>Likely, lasts longer than 4 days</td>
</tr>
</tbody>
</table>
Post Concussion Management

• Physical Rest
  – Holding an athlete out after a concussion is not just about reducing the risk of a second injury
  • Any physical exercise in the days after a concussion redirects glucose away from the healing processes occurring within the brain
  • Slows the restoration of neural pathways and may exacerbate symptoms

Post Concussion Management
Pharmacology

• Two Categories
  1. Drugs used to treat post-concussion symptoms
  2. Drugs used to improve or accelerate the healing process

Pharmacology
Treatment of Post Concussion Symptoms

• Control sleep disturbances or reduce headaches

• Before return-to-play
  – Athlete must be able to stop taking these medications and remain symptom free before beginning a return-to-play protocol
Pharmacology
Improvement or acceleration of the healing process

• Corticosteroids, vitamin C, glutamate receptors, calcium channel inhibitors, and drugs that affect the arachidonic acid cascade

• All have been studied without producing consistent positive results

Pharmacology
Improvement or acceleration of the healing process

• Progesterone
  – Most promising pharmacological agent for boosting recovery
  – Not fully understood how it works
    • Thought to decrease the post-injury inflammatory response in the brain
  – Entering large-scale clinical trials later this year

Repeated Concussions

• Once a patient has sustained an initial cerebral concussion, his or her chances of incurring a second concussion are three to six times greater than for a patient who has never sustained a concussion

• Severity and duration of functional impairment may be greater
  – Changes may be cumulative
Second-Impact Syndrome

• Occurs because of rapid swelling and herniation of the brain after a second head injury that occurs before the symptoms of a previous head injury have resolved

Second-Impact Syndrome

• Second impact may be relatively minor

• Resulting symptoms occur because a disruption of the brain’s blood autoregulatory system leads to swelling of the brain

• Most likely to occur in individuals less than twenty years of age

Second-Impact Syndrome

• Signs and Symptoms
  – Within 15 seconds to several minutes, the patient’s condition worsens rapidly
  – Dilated pupils
  – Loss of eye movement
  – Loss of consciousness leading to coma
  – Respiratory failure

• Life-threatening situation that has a mortality rate of ~50%
Second-Impact Syndrome

• Management
  – Must be addressed within “5 minutes by dramatic life saving measures performed in an emergency care facility

Pre Concussion Management

• Begins with baseline testing in the preparticipation physical examination

• Provides an individualized “normal” to be used for comparison should an injury occur

• Baseline scores are obtained for the Balance Error Scoring System (BESS) and the SAC
  – Easily readministered on the sideline after injury

BESS

• Provides a portable, cost-effective, and objective method for assessing static postural stability

• Can be performed in nearly any environment and takes approximately 10 minutes to conduct.
BESS

• Materials needed
  – Two testing surfaces
    • Floor/ground
    • Foam pad (Airex Balance Pad)
  – Stop watch
  – An assistant to act as a spotter
  – BESS Testing Protocol
  – BESS Score Card

BESS

• Consists of 6 – twenty second test with three different stances on two different surfaces

BESS

• Double leg stance-Ground
  – Eyes closed
BESS

• Single leg stance-Ground
  – Standing on the non-dominant foot
  – Eyes closed

BESS

• Tandem Stance-Ground
  – Non-dominant foot in back
  – Eyes closed

BESS

• Double leg stance-Foam
  – Eyes closed
**BESS**

- **Single leg stance-Foam**
  - Standing on the non-dominant foot
  - Eyes closed

- **Tandem Stance-Foam**
  - Non-dominant foot in back
  - Eyes closed

**BESS**

- **Types of Errors**
  1. Hands lifted off the iliac crest
  2. Opening eyes
  3. Step, stumble, or fall
  4. Moving hip >30 degrees abduction
  5. Lifting forefoot or heel
  6. Remaining out of test position >5 seconds
**BESS**

- Maximum number of errors for any single condition is 10

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**Balance Error Scoring System (BESS)**

<table>
<thead>
<tr>
<th>Score Card (# errors)</th>
<th>Firm Surface</th>
<th>Foam Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Leg Stance (feet together)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Leg Stance (non-dominant foot)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tandem Stance (non-dom foot in back)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BESS Total:</td>
<td></td>
<td></td>
</tr>
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</table>

Which foot was tested: ___ Left ___ Right
(i.e. which is the non-dominant foot)

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**Standardized Assessment of Concussion (SAC)**

- Brief mental status test that was designed to provide immediate, objective data concerning the presence and severity of neurocognitive impairment associated with memory recall, concentration, and delayed recall
ImPact

- Computerized concussion evaluation system
- 20 minute test that measures multiple aspects of cognitive functioning
  - Attention span
  - Working memory
  - Sustained and selective attention time
  - Response variability
  - Non-verbal problem solving
  - Reaction time

ImPact

- Four Sections
  1. Demographic Profile and Health History Questionnaire
  2. Current Symptoms and Conditions
  3. Baseline and Post-Injury Neurocognitive Test
     a) Comprised of 6 modules
  4. Graphic Display of Data
ImPact Research

• “As part of a formal concussion management program, ImPact is a useful tool for the assessment of the neurocognitive and neurobehavioral sequelae of concussion, and can provide post-injury cognitive and symptom data that can assist a practitioner in making safer return to play decisions.”

ImPact Research

• “Three contemporary computer-based concussion assessment programs evidenced low to moderate test-retest reliability coefficients.”
  — ImPact, Concussion Sentinel, and Headminder Concussion Resolution Indec

ImPact Research

• “No studies have demonstrated that ImPact is sensitive to the effects of concussion once subjective symptoms have resolved.”
Developing a Protocol

- Use a combination of brief screening tools and neuropsychological testing

- Decisions about an athlete should never be based solely on the use of any one test.

The Latest

- Concussion Bills
- New Guidelines
- New Rules

House approves concussions bill

Associated Press

WASHINGTON — The House has voted to set federal guidelines on diagnosing concussions among student athletes and protecting young people suffering mild injuries from long-term health problems.

The bill would require the government to convene a conference of medical, athletic and education experts to come up with guidelines that address the prevention, identification, treatment and management of concussions in school-aged children. They would include standards for allowing children to return to play after suffering a concussion.

The bill, sponsored by New Jersey Democratic Rep. Bill Pascrell, is one of several Congress is considering in response to evidence that improperly treated concussions can cause long-term problems. The most severe cases involve brain swelling and other degenerative changes, but milder injuries — like the one former San Francisco 49ers quarterback Joe Montana suffered in the 1984 NFC title game — can lead to long-term headaches, confusion and memory loss.

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American Academy of Neurology Recommendations

1. Any athlete who is suspected to have suffered a concussion should be removed from participation until he or she is evaluated by a physician with training in the evaluation and management of sports concussions.

2. No athlete should be allowed to participate in sports if he or she is still experiencing symptoms from a concussion.

3. Following a concussion, a neurologist or physician with proper training should be consulted prior to clearing the athlete for return to participation.
• American Academy of Neurology Recommendations
  4. A certified athletic trainer should be present at all sporting events, including practices, where athletes are at risk for concussion.

• American Academy of Neurology Recommendations
  5. Education efforts should be maximized to improve the understanding of concussion by all athletes, parents, and coaches.
Conclusion

• Are we doing all that we can for athletes who have sustained a concussion?

• What is your concussion policy and procedure?

Questions?

• References available upon request.
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