Management of the Concussed Athlete

Disclosure Statement of Financial Interest

I, Eric D. Parks, MD, DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

Objectives

- Provide overview of management strategies for concussion
- Discuss the immediate treatment principles
- Review indications for referral for further evaluation and imaging
- Examine methods of treatment of the 4 categories of symptoms
- Review evidence for medication use in the management of concussion
- Discuss role of physical therapy in concussion management
- Overview of neuropsychological testing
- RTP
General Treatment Principles

- A majority resolve within 7-10 days
- 10-30% may have prolonged symptoms
- No universal guidelines on how to treat
- Emphasize RTL before RTP

Multi-Speciality Team Approach

- Establish a concussion management plan preseason
- Physician (PCP & neurologist), neuropsychologist, psychologist, ATC, PT, school administrators, parents/guardians
Individualized Treatment Plan

- Know your athlete
- Management is based on status and progress of the individual rather than grading systems

Remember the Underlying Pathology

- Concussion is not a structural injury, it is a functional injury
  - Energy mismatch- Supply & Demand
- Most will improve within 1-2 wks given proper opportunity for physical & cognitive rest

Initial Treatment

- Management begins at the moment of diagnosis & primary survey
- Determine initial disposition
- If no health care provider available- urgent referral
Primary Survey

- Assess the airway, breathing, and circulation status
- Immediate concern is to rule out a cervical spine injury
- LOC carries potential for c-spine injury
- Precautions until proper neurological evaluation
- *Always remember cardiac sources

Primary Survey

- Assess for immediate indications for transfer
  - Cervical Spine Injury
  - Skull fracture
  - otorrhea, rhinorrhea, raccoon eyes, battle sign, bleeding from nose or ear
  - LOC not regained

C-Spine Clearance

- Does NOT take precedence over life threatening injuries
- Alert, asymptomatic
- Controversial in pts with altered mental status
- No distracting injuries/neurologic deficits
- Able to complete functional ROM exam
- Pain free range of active motion
One of your high school football players comes off the field complaining of dizziness and headache. Exam is completely normal. Dizziness clears within the first few minutes but he continues to have a headache. Would you let the athlete return to play?

A. Yes  
B. No

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**Sideline Management**

- Once c-spine cleared and immediate indications for referral are excluded, remove from field of play
- No same day return to play!!
- Essential to exclude focal deficits that warrant referral
- Monitor for worsening condition/deterioration
- Do not leave alone following the injury
- Medication use on sideline?
- Keep the parents/guardians informed
Indications for ER Referral

- Progressive symptoms
- Change in vital signs
- Difficulty maintaining arousal
- Worsening headache
- Very drowsy
- Difficulty recognition of place or people

- Development of seizure activity
- Slurring speech
- Unsteady gait
- Develop focal deficits

Do you personally think there is a role for advanced imaging (CT, MRI) for the routine management of sports related concussion?

A. Yes  
B. No
Advanced Imaging?

- Not recommended as routine part of sports related concussion management
- CT modality of choice to rule out acute intracranial injury
- MRI for shear injury to the white matter
- Other functional scans in development

Indications for Imaging

- Prolonged LOC
- Worsening symptoms, develop focal deficit(s)
- CATCH rule
  - High risk: GCS < 15 @ 2hr, suspected open or depressed skull fx, worsening HA, irritability
  - Medium risk: signs of basal skull fx, boggy hematoma of the skull, dangerous MOI

Homeward Bound?

- If no evidence of deterioration, home care with observation is appropriate if:
  - Responsible caretaker
  - Sufficient ability to seek care if needed
  - Give written instructions on indications for which they should seek medical attention
  - Periodic waking?
Treatment Overview

Rest until acute symptoms resolve

Begin graded program of exertion

Medical clearance and return to play

4 Categories of Symptoms

- Physical
- Cognitive
- Emotional
- Sleep
The Keystone of Treatment

Consensus agreement that COGNITIVE and PHYSICAL rest are the keystone of concussion management.

Physical Rest

- Maintain physical rest until asymptomatic at rest, then may begin gradual RTP
- May take longer in younger athletes
- Exercise too soon after concussion is detrimental to recovery
  - May be counterproductive if rest too long

Physical Rest Strategies

- All team/individual sports restrictions
- Recreational sports
- PE class
- Physiologic stress
  - Altitude, flying
- ETOH, sedatives, recreational drugs
Cognitive Rest

- Concussion impacts learning, memory, attention, processing speeds, reaction time
- Activities requiring concentration and attention
- ‘Cognitive participation’ may lead to ‘cognitive overexertion’

Cognitive Rest Strategies

- Limit those activities that exacerbate symptoms
  - TV, cell phones, video games, music, computer work, reading
  - May have to limit or remove student from school temporarily

School Impact

- Temporary absence from school may be necessary
- No clear guidelines for returning to school
- Improvement of symptoms and student can handle cognitive tasks without worsening symptoms, ok to return
Graded Return to Learn

- A gradual return is advocated
  - 1/2 days, class load accommodations, frequent breaks, extra time for assignments, delay exams
  - Frequent breaks, quiet areas to work, limit time reading books/computer work
  - Avoid noisy areas (lunchroom, band room, pep rallies)

Dealing with Teenager Emotions

- Counsel the students of the challenge of returning to the classroom
  - Anxiety
  - Depression

Medications for Concussion Symptoms

- No effective pharmacological treatment speeds recovery from TBI
  - Most studies from severe brain injury
  - Poor evidence for post concussion symptom control
  - Choices same as for non concussion symptoms
The same athlete then asks you for medicine for his headache. Would you give him any OTC medications from your sideline bag?

A. Yes
B. No

Medications for Concussion Initial hours

- Avoid medications that affect the ongoing evaluation of cognition
  - BZD, anti-emetics
- Some may facilitate symptom progression
  - NSAIDs, ASA

Symptomatic Treatment

- Headache
  - Tylenol & NSAIDs (later) helpful — beware rebound HA
  - Amitriptyline (conflicting evidence)
- Sleep
  - Focus on sleep hygiene and observation
  - Melatonin, trazadone, nonBZD (ambien, TCADs); avoid BZD (memory impact)
- Depression
  - SSRI, TCADs
Symptomatic Treatment

- Neurobehavioral Symptoms
  - Amantadine effective for arousal, executive functioning in kids (3 wk trial)
- Attention Issues
  - Academic demand modifications initially
  - Methylphenidate (attention deficits and processing speed)
  - NCAA implications

Symptomatic Treatments Under Investigation

- Corticosteroids
  - Stabilize membranes, reduce inflammation
- Antioxidants
  - Physical, cognitive, and affective issues in animal studies
  - CCB - Several studies- no protective benefit

Symptomatic Treatments Under Investigation

- Hyperbaric Oxygen
  - May enhance cerebral oxygenation, cerebral VC, glucose metabolism, reducing cerebral edema
- Nicotinamine (B3)
  - Neuroprotectant after brain injury in animal models
- Omega-3 FA
  - ? Protective effect on concussed brain
Physical Therapy

- Orientation dependent on:
  - proprioceptive, visual, vestibular systems
  - Vestibular and cervical spine may facilitate recovery in patients s/p concussion
  - Recommend control headaches first, then start the therapy

Vestibular Therapy

- Individualized program of
  - habituation
  - gaze stabilization
  - adaption exercises
  - canalith repositioning

Postural Stability

- Sensory integration exercises
- Oculomotor training
- Eye-head coordination
- Balance training
- Visual motor sensitivity training
- NM control
- Body mechanics and posture
Principles of Reevaluation

- Periodic office visits and/or training room visits
- Assess symptoms, cognition, emotional, sleep
- Neuropsych testing, postural stability testing (BESS), SCAT3
  - None exclusively effective, but combination

Neuropsychological Testing

- Physical recovery may precede cognitive recovery
- Sensitive to change in cognitive function
- No consensus on which test is most effective
- Not sole basis for decision making
- When to administer, how frequent?
  - Drawbacks
    - Cost, S/S to be determined, results not always clear cut

Concern for Prolonged Recovery

- Concussion modifiers
  - # concussions, prolonged LOC>1 min, concussion convulsions, progressively increasing time of recovery
  - Medical issues- ADHD, migraines, learning disabilities, sleep disorders, drug use
- Children
- Genetics
  - ApoE4, Apo promoter gene, Tau polymerase
Return to Play

- Controversial and difficult decision
- No gold standard measure of brain disturbance and recovery
  - Indirect measures
  - Rest, monitor symptoms/signs of recovery, use NP testing to estimate cognitive function, graduated RTP with close monitoring
  - No more of the ‘tough it out’ mentality

RTP

- 1. No activity, complete rest
- 2. Light aerobic exercise
- 3. Sport specific exercise
- 4. Noncontact training drills
- 5. Full contact training
- 6. Game play

If symptomatic, drop back to previous level and retry after 24 hr rest

Free of pharmacological agents that modify symptoms of concussions

Post Concussive Sequelae

- Second Impact Syndrome
- Post concussion syndrome
- Post traumatic seizures
### Second Impact Syndrome

- 2nd concussion while pt still symptomatic from initial injury
- 2nd injury usually minor
- Massive uncontrollable cerebral edema, herniation
- Sudden onset (15 sec - 5 min)
- 100% morbidity, 50% mortality
- Usually < 20 yo

### Post Concussion Syndrome

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<thead>
<tr>
<th>Symptom</th>
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<tbody>
<tr>
<td>Fatigue</td>
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<tr>
<td>Headache</td>
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<tr>
<td>Dizziness</td>
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<tr>
<td>Noise intolerance</td>
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<td>Irritability</td>
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<td>Concentration</td>
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<td>on difficulties</td>
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<td>Nausea</td>
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<td>Memory problems</td>
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<td>Blurry vision</td>
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<td>Sleep disturbances</td>
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<td>Appetite</td>
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<td>Anxiety</td>
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<td>Depression</td>
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### Post-traumatic Seizures

- Seizures weeks to months after concussion
- Seizure management and precautions
- Anti-convulsive medications
Prevention

- No evidence that protective gear prevents concussions
- Education
- Permanent removal from play?
- Legislation
- Rule Changes
- Risk compensation
  - dangerous playing techniques

PPE

- Detailed concussion history
  - # concussions
  - symptoms
  - length of symptoms
  - Baseline NP testing
  - Baseline cognitive assessments

Treatment Summary

- Most will recover within 7-10 days
- Physical and Cognitive Rest is the cornerstone of treatment for concussion
- Multi-Speciality team assembled in advance
- Return to Learn before Return to Play
Thank You!

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