Concussion Evaluation & Management

Priscilla Tu, DO, FAOASM, FAAFP
OMED 2016
September 19, 2016

Objectives

• Briefly review concussion basics
• Review most recent consensus statement on concussion evaluation and management
• Discuss latest research in evaluation and management of concussions

Disclosures

• Unfortunately, I have no financial disclosures.
Int’l Conference on Concussion in Sport
• November 2001 – Vienna, Austria
• November 2004 – Prague, Czech Republic
• November 2008 – Zurich, Switzerland
• November 2012 – Zurich, Switzerland
• October 2016 – Berlin, Germany

Concussion Definition
• Complex pathophysiological process affecting the brain, induced by biomechanical forces
  • “Impulsive” force transmitted to head
  • Typically rapid onset of short-lived impairment of neurologic function that resolves spontaneously
  • Usually a functional disturbance
  • Graded set of clinical symptoms
  • Resolution usually follows sequential course

Science in Concussion
• Impact → brain cell membranes stretch and tear → cannot maintain environment; can → death of cell
  • Increases metabolic demand = must work harder to perform (& repair)
  • Injury → imbalance K, Na, glutamate (can be toxic)
  • Energy crisis to brain cells
  • Axonal shear → ability of cells to send signals compromised
  • Too much → permanent damage
Energy Crisis

Epidemiology
• 1.6-3.8 million annually in US

Problem in Concussion
• Underreported
• Media
• Culture change needed → EDUCATION
Concussion Data

- 85-90% college concussions resolve in 7 days (mean = 3-5 days)
- H/O concussion → almost 6x more likely to have another
- H/O >=3 → 30% w symptoms >1 week
- Greatest risk of repeat concussion = 1st 10 days

Concussion Diagnosis

- Symptoms—somatic (eg, headache), cognitive (eg, feeling like in a fog) and/or emotional symptoms (eg, lability).
- Physical signs (eg, loss of consciousness, amnesia).
- Behavioral changes (eg, irritability).
- Cognitive impairment (eg, slowed reaction times).
- Sleep disturbance (eg, drowsiness).

Concussion Diagnosis

- Important to obtain a detailed concussion history
- At injury
- PPE

Concussion History Study Questionnaire*

- Have you ever had a concussion or head injury?
- While playing a sport?
- While participating in a recreational activity?
- Have you ever been knocked out?
- While playing a sport?
- While participating in a recreational activity?
- Have you ever had your "bell rung" or been "dazed"?
- While playing a sport?
- While participating in a recreational activity?

* If any response to any question resulted in the placement of the participant in the Immediate Removal/Headache protocol.
Pre-season Baseline Testing

What is it?
• Symptom checklist
• Cognitive assessment
  • SAC, SCAT3 (Child)
  • Balance
• Neuropsychological
• Education of players, coaches, parents

When
• HS – may do every other year
• College – may do as freshman
• Consider repeat baseline if had concussion in previous year

Sideline Evaluation
• ANY signs of concussion →
  • Evaluation by healthcare provider on site
  • Appropriate disposition determined
  • Assessment Tool (SCAT3) p 15 min – AxO unreliable
  • Serial monitoring – do NOT leave patient alone

Sideline Assessment Tool
• Have a standard method and DOCUMENT
• Pocket Concussion Recognition Tool
  • Visible clues
  • Signs/Symptoms
  • Memory Function
• SCAT3 and Child SCAT3
Return to Play?

• If symptoms and on-field/sideline evaluation consistent with concussion →

NO RTP

• Especially true for pediatric population
• Education and culture change needed

Evaluation in Office

• Comprehensive history (include previous injuries)
• Detailed neurological examination
  • Mental status
  • Cognitive functioning
  • Gait / vestibular evaluation
  • Balance / postural testing
• Clinical status – improvement or deterioration since injury/previous assessment
Evaluation in Office

Neuropsychological Assessment
• May be used to assist in RTL and RTP decisions
• Should NOT be the sole basis of management decisions

Neuropsych Testing Problems
• Baseline
• Test-retest reliability
• When do you test? Bad sx? Asx?
• Practice effect
• More studies needed (not by ImPACT)
Neuroimaging
• CT initially to r/o bleed
• MRI – post-concussion symptoms
  • Structural changes
• DTI, fMRI, SPECT – still investigational

Concussion Treatment
• “The cornerstone of concussion management is physical and cognitive reset until the acute symptoms resolve and then a graded program of exertion prior to medical clearance and return to play.”

Acute Management
• Physical / Cognitive Rest
• NSAIDs/Tylenol
• Physical Therapy
  • Vestibular (if dizziness)
  • Cervical (if HA or neck pain)
• OMT – cervical, craniosacral
• DHA
Post-Concussion Syndrome

- Symptomatic medication (ADHD, migraine, depression)
- Vestibular PT (coordination, balance, ambulation)
- DHA
- Hyperbarics
- Moderate exercise
- OMT

Concussion Modifiers

<table>
<thead>
<tr>
<th>Factors</th>
<th>Modifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>Duration (&lt;10 d)</td>
</tr>
<tr>
<td></td>
<td>Severity</td>
</tr>
<tr>
<td>Signs</td>
<td>Prolonged loss of consciousness (&lt;1 min)</td>
</tr>
<tr>
<td>Sequeal</td>
<td>Concussive convulsions</td>
</tr>
<tr>
<td>Temporal</td>
<td>Frequency delayed convulsions over time</td>
</tr>
<tr>
<td></td>
<td>Timing injuries close together in time</td>
</tr>
<tr>
<td></td>
<td>“Pressure” - recent concussion or traumatic brain injury</td>
</tr>
<tr>
<td>Threshold</td>
<td>Repeated concussions occurring with progressively less impact force or slower recovery after each cumulative concussion</td>
</tr>
<tr>
<td>Age</td>
<td>Child or adolescent (&lt;18 y old)</td>
</tr>
<tr>
<td>Comorbidities and co-occurring conditions</td>
<td>Migraines, depression, or other mental health disorders, attention deficit hyperactivity disorder (ADHD), learning disabilities (LDs), sleep disorders</td>
</tr>
<tr>
<td>Medication</td>
<td>Psychiatric drugs, anticonvulsants</td>
</tr>
<tr>
<td>Behaviour</td>
<td>Dangerous style of play</td>
</tr>
<tr>
<td>Sport</td>
<td>High-risk activity, contact and collision sport, high sporting level</td>
</tr>
</tbody>
</table>
What About….?

- Genetic testing?
- ERP? EEG?
- Role of gender?
What About…?

- Genetic testing?
- ERP? EEG?
- Role of gender?
- LOC?
- Amnesia?
- Convulsions?
What About….?

• Genetic testing?
• ERP? EEG?
• Role of gender?
• LOC?
• Amnesia?
• Convulsions?
• Depression?

What About….?

• Genetic testing?
• ERP? EEG?
• Role of gender?
• LOC?
• Amnesia?
• Convulsions?
• Depression?
• Children?

What About….?

• Genetic testing?
• ERP? EEG?
• Role of gender?
• LOC?
• Amnesia?
• Convulsions?
• Depression?
• Children?
• Elite v non-elite?
Prevention – Equipment

• Helmets?

• Mouthguards?

• Neck strengthening?
Prevention

- Helmets?
- Mouthguards?
- Neck strengthening?
- Rule changes?

Retirement

**Season Ending**
- Prolonged post concussion syndrome
- \(\geq 3\) in one season
- \(\geq 2\) major in one season
- Diminished academic or athletic performance
- CT/MRI abnormality

**Career Ending**
- Chiari malformation
- Intracranial hemorrhage
- Diminished academic performance or cognition
- Persistent/prolonged post-concussion syndrome
- Lowering threshold for concussion
- \(\geq 3\) major
- CT/MRI structural abnormalities

**WHAT IF I TOLD YOU**
**THERE'S AN APP FOR THAT**

[memegenerator.net]
Diagnosis – App

- HHITT = Handheld Head Injury Treatment

Gaze Stabilization Test Asymmetry Score

- Athletes with previous concussion had larger GST asymmetry scores than those without

Apolipoprotein E Genotype

- Carriers of 3 APOE rare alleles = 10x more likely to report previous concussion
- Carriers of promoter rare allele = 8.4x more likely multiple concussions
Cranial Accelerometry

Treatment

Virtual Reality Balance  Exercise Treadmill

Return-to-Learn Plan

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>No activity</td>
<td>Complete cognitive rest — no school, no homework, no reading, no screening, no video games, no computer work.</td>
<td>Recovery</td>
</tr>
<tr>
<td>Gradual introduction of cognitive activity</td>
<td>Make previous restrictions on activities and add back for short periods of time (1-15 minutes at a time).</td>
<td>Gradual controlled increase in submaximal treadmill cognitive activities.</td>
</tr>
<tr>
<td>Homework at home before schoolwork at school</td>
<td>Homework in began increments (20-30 minutes at a time). Increase cognitive demands by replication of short periods of self-paced cognitive activity.</td>
<td></td>
</tr>
<tr>
<td>School re-entry</td>
<td>Ten days after tolerating 1-2 cumulative hours of homework at home.</td>
<td>Asentrée into school with accommodations to permit controlled submaximal treadmill increase in cognitive load.</td>
</tr>
<tr>
<td>Gradual integration into school</td>
<td>Increase of 1/2 day of school.</td>
<td>As accommodations decrease as cognitive demands improve.</td>
</tr>
<tr>
<td>Resumption of full cognitive workload</td>
<td>Introductory catch-up with essential work.</td>
<td>Full return to school may commence Return to Play protocol (see Step 2 in Table 2).</td>
</tr>
</tbody>
</table>

Source: Sub T. Initiative Guide to Return to Play.
Concussion Pearls

• When in doubt, keep them out!
• Tx: physical AND cognitive rest
• Graduated RTP and RTL protocols
• Thorough PPE and H&P
• No two brains are the same
References


References