Heads up! Tackling the Topic of Concussions

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Disclosure

- I have no actual or potential conflict of interest in relation to this program/presentation.
Objectives

- Determine evidence based guidelines on diagnosis of concussions.
- Discuss concussion management and emerging therapies.
- Discuss strategies for concussion prevention: changing game rules, techniques, and laws.
Concussion

- Disturbance in brain function caused by direct or indirect force to the head
- Functional over structural injury
  - Results from shear stress to brain tissue caused by rotational/angular forces
- May involve loss of consciousness (10%)
- 1.6 – 3.8 million sports-related concussions occur each year in the US.
- Head injuries are the leading causes of sports deaths
- Associated conditions – rule out neck injuries
Concussion

- Pathophysiology
  - Rotational and angular forces to the brain
  - Direct impact to the head is not required
  - Shear forces disrupt neural membranes
    -- Allow K+ efflux into extracellular space
    -- Increase Ca2+ and excitatory amino acids by further K+ efflux, causes suppression of neuron activity
  - As Na/K pump restores balance, there is an increased energy requirement, which decreases cerebral blood flow
Concussion

- Initial evaluation – r/o c-spine injury and serious traumatic brain injury
- Sx: headache is most common
- Symptoms can present immediately after injury, but can also be delayed for several hours.
- Symptoms tend to last less than 72 hours
- Most concussions resolve in 7-10 days
- Recovery may be prolonged in children, adolescents, and hx of previous concussions.
Assessment

- Sport Concussion Assessment Tool (SCAT5)
  - Assesses several domains to diagnose concussion and monitor recovery.

- Other diagnostic tools
  - ImPACT
  - King-Devic Test
  - Future – Biomarkers?
    - Copeptin
    - Galectin 3
    - Glial fibrillary acidic protein
    - MMP 9
    - Occludin
    - Ubiquitin carboxyl-terminal hydrolase isozyme L1
- Developed by the 5th International Conference of Concussion in Sport in Berlin, 2016
- Supported by
  - International Ice Hockey Federation
  - FIFA
  - IOC
  - World Rugby Union
  - FEI (Fédération Equestre Internationale)
- Most common assessment tool used for evaluation
- Can be done on-field, or in the office
• On-field assessment
• Red-flags – should be removed from play and assess
  – Neck pain/tenderness
  – Double vision
  – Weakness/tingling in arms/legs
  – Worsening headache
  – Seizure or convulsion
  – LOC
  – Deteriorating consciousness
  – Vomiting
  – Increasing restlessness, agitation, or combative
- Observe signs – laying motionless, slow to get up, disorientation, “blank look”, facial injury after trauma
- Maddocks Questions
  - What venue are we at today?
  - Which half is it now?
  - Who scored last?
  - What team did you play last week?
  - Did your team win the last game?
- On-field assessment
- Do a GCS, C-spine assessment
- If the athlete is not lucid or fully conscious, a c-spine injury should be assumed until proven otherwise
- Neurocognitive assessment should be done in a distraction free environment
- Ask the patient/parent the following
  - Date of injury
  - Mechanism of injury
  - History of:
    - Headaches/migraines
    - Learning disability/dyslexia
    - Depression, anxiety, or other psychiatric issues
Go through the symptom checklist
- Headaches, neck pain, irritability, light sensitivity, feeling in a “fog”
### Cognitive Screening

#### ORIENTATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>What month is it?</td>
<td>0</td>
</tr>
<tr>
<td>What is the date today?</td>
<td>0</td>
</tr>
<tr>
<td>What is the day of the week?</td>
<td>0</td>
</tr>
<tr>
<td>What year is it?</td>
<td>0</td>
</tr>
<tr>
<td>What time is it right now? (within 1 hour)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Orientation score**

0 of 5
### Immediate Memory Recall

<table>
<thead>
<tr>
<th>List</th>
<th>Alternate 5 word lists</th>
<th>Score (of 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Trial 1</td>
</tr>
<tr>
<td>A</td>
<td>Finger</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Penny</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blanket</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lemon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insect</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Candle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paper</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sugar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sandwich</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wagon</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Baby</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monkey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perfume</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sunset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iron</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Elbow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carpet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saddle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bubble</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Jacket</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pepper</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotton</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Movie</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Dollar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Honey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mirror</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saddle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anchor</td>
<td></td>
</tr>
</tbody>
</table>

**Immediate Memory Score**

<table>
<thead>
<tr>
<th></th>
<th>of 15</th>
</tr>
</thead>
</table>

**Time that last trial was completed**

|                         |             |
### Digits backwards

<table>
<thead>
<tr>
<th>Concentration Number Lists (circle one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>List A</td>
</tr>
<tr>
<td>4-9-3</td>
</tr>
<tr>
<td>6-2-9</td>
</tr>
<tr>
<td>3-8-1-4</td>
</tr>
<tr>
<td>3-2-7-9</td>
</tr>
<tr>
<td>6-2-9-7-1</td>
</tr>
<tr>
<td>1-5-2-8-6</td>
</tr>
<tr>
<td>7-1-8-4-6-2</td>
</tr>
<tr>
<td>5-3-9-1-4-8</td>
</tr>
</tbody>
</table>
- Ask for the months of the year backwards
- If patient is younger, may do days of the week backwards
- Neurological screen
  - Have patient read the symptom checklist out loud
  - Assess cervical spine – range, passive/active
  - Have patient look up/down, side to side, and assess for double vision
  - Finger to nose coordination
  - Tandem gait
- **Modified BESS (Balance Error Scoring System)**
- Hands on hips, eyes closed, hold position for 20 seconds
- Single leg test should be done on non-dominant foot

<table>
<thead>
<tr>
<th>Condition</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double leg stance</td>
<td>of 10</td>
</tr>
<tr>
<td>Single leg stance (non-dominant foot)</td>
<td>of 10</td>
</tr>
<tr>
<td>Tandem stance (non-dominant foot at the back)</td>
<td>of 10</td>
</tr>
<tr>
<td>Total Errors</td>
<td>of 30</td>
</tr>
</tbody>
</table>
### Errors

- Hands off hips
- Opening eyes
- Stumble/fall
- Moving hip > 30 degrees abduction
- Lifting forefoot or heel
- Remaining out of position > 5 seconds
- Last step – Delayed recall
- “Remember those 5 words? What were they?”
- Last step – Add the scores
- For follow up visits, note if scores have improved

**STEP 6: DECISION**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Date &amp; time of assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom number (of 22)</td>
<td></td>
</tr>
<tr>
<td>Symptom severity score (of 132)</td>
<td></td>
</tr>
<tr>
<td>Orientation (of 5)</td>
<td></td>
</tr>
<tr>
<td>Immediate memory</td>
<td><strong>of 15</strong></td>
</tr>
<tr>
<td></td>
<td><strong>of 30</strong></td>
</tr>
<tr>
<td>Concentration (of 5)</td>
<td></td>
</tr>
<tr>
<td>Neuro exam</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
</tr>
<tr>
<td>Balance errors (of 30)</td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td><strong>of 5</strong></td>
</tr>
<tr>
<td></td>
<td><strong>of 10</strong></td>
</tr>
</tbody>
</table>
### Treatment

- **Cognitive rest!**
  - No texting, no TV, no homework
- **Once asymptomatic, initiate return to play (RTP protocol)**

<table>
<thead>
<tr>
<th>Rehabilitation stage</th>
<th>Functional exercise at each stage of rehabilitation</th>
<th>Objective of each stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No activity</td>
<td>Physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>Light aerobic exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity, 70% maximum predicted heart rate. No resistance training</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>Sport-specific exercise</td>
<td>Skating drills in ice hockey, running drills in soccer. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>Non-contact training drills</td>
<td>Progression to more complex training drills, eg passing drills in football and ice hockey. May start progressive resistance training</td>
<td>Exercise, coordination, and cognitive load</td>
</tr>
<tr>
<td>Full contact practice</td>
<td>Following medical clearance participate in normal training activities</td>
<td>Restore confidence and assess functional skills by coaching staff</td>
</tr>
<tr>
<td>Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>
Medications

- Acetaminophen – blocks pain impulse generation, also inhibits prostaglandin synthesis in CNS
- Avoid narcotics, “PM” medications
- Overuse of analgesics following injury may exacerbate concussion related headaches

Off label
- Fish oil (DHA component) may assist in brain health and recovery. ~ 500 mg of DHA daily
- Melatonin (0.3 mg to 3 mg) to help with sleep
Vestibular rehabilitation
- Return to Learn Protocol
- For adolescents, consider academic accommodations
- Stage 1: No school. No homework. No reading.
- Stage 2: Easy tasks at home. Soft music. Can advance if symptoms do not worsen after 60-90 minutes of light mental activity
- Stage 3: Return to school. Half-day if needed. Frequent breaks. Avoid loud areas (gym, cafeteria). Allow extended time to do assignments. Tutoring if needed.
- Stage 4: Full day of school. No more than 1 test per day. Give extra time for homework/untimed tests. Tutoring as needed.
- Stage 5: Normal school schedule
# Return to Learn Communication Tool

## Stage 1: Restricted Cognitive Activity
- Cognitive rest at home.
- Restrict cognitive activities (i.e., schoolwork, reading, texting, video games, computer).

### Recovery
- Symptom-free for 24 hours?
  - Yes: Begin Stage 2
  - No: Continue resting
- Time & date completed:

## Stage 2: Gradual Reintroduction of Cognitive Activity
- Add cognitive activities. Start with 5-15 minutes at a time. Build to a 60-minute session without a break.

### Add Cognitive Activity
- Tolerates cognitive activity for 1 hour without a break?
  - Yes: Move to Stage 3
  - No: Return to Stage 1
- Time & date completed:

## Stage 3: Homework at Home
- Add homework. Start with 20 minute sessions. Work up to the equivalent of half a school day (3-4 hours).

### Increase Stamina with Self-Paced Activity
- Tolerates 3-4 hours of trial school schedule at home?
  - Yes: Move to Stage 4
  - No: Return to Stage 2
- Time & date completed:

## Stage 4: School Part-Time
- *Inform school*
- Attend only quieter classes. No gym class, noisy locations, tests, or heavy backpacks.
- Start with half-day, work up to full day of quieter classes.
- At home, 15 minute homework blocks for up to 1 hour daily.

### Begin Gradual Return to School
- Tolerates a full day of school with modifications?
  - Yes: Move to Stage 5
  - No: Return to Stage 3
- Time & date completed:

## Stage 5: Full Days of School
- Do less than 5 days if needed. Homework as tolerated. Maximum one test per day, with option of extra time to complete. No gym class.

### Work Up to Some Full Days at School
- Tolerates a full school day and a normal workload?
  - Yes: Return to play
  - No: Return to Stage 4
- Time & date completed:

## Stage 6: School Full-Time
- Resume full cognitive workload. Catch up with homework and tests.

### Physical Activity: Begin Return to Play Communication Tool

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Return to Learn should be completed before Return to Play.

If symptoms reappear at any stage, go back to the previous stage. You may need to move back a stage more than once during the recovery process.

Physical activity during Return to Learn is restricted to walking as tolerated.
Complications

- **Second Impact Syndrome (SIS)**
  - 2\textsuperscript{nd} minor blow to head before initial symptoms resolve
  - Due to loss of autoregulation of the brain’s blood supply
  - 50% mortality rate
  - Affects adolescent males more

- **Epidural bleeding**
  - Lucid period before neurologic decline
  - Neurosurgical decompression and seizure prophylaxis indicated

- **Cumulative effects**
  - Cumulative effects of repeated concussions is controversial

- **Postconcussion syndrome**
  - Headache, confusion
  - RTP contraindicated
Concussions in the news

- **JAMA. July 25, 2017**
  - 202 donated brains, former football players
  - 177 out of 202 brains had signs of CTE
  - 110 out of 111 NFL player’s brains had CTE

- **Brain. Feb 1, 2018**
  - “…repetitive neurotrauma, including sports-related closed-head impact injuries, as a major risk factor for later development of chronic traumatic encephalopathy (CTE)”
USA Football – Heads up football program

- Teaches coaches and athletic directors on:
  - Concussion recognition and response
  - Heat preparedness and hydration
  - Cardiac arrest
  - Proper equipment fitting
  - Shoulder tackling
  - Blocking
Ways to improve the game

- Concussion Foundation – Flag Football Under 14 Initiative
Ways to improve the game

- US Soccer Recognize to Recover program
  - No heading for U-11 or under
  - U-12, U-13 – limited heading in practice
    - Max 30 minutes of heading practice/week
    - No more than 15-20 headers per week
  - Rules are by age, not by skill
    - 10 yo playing in U-12 should not head the ball
Ways to improve the game

- Ice Hockey
- USA Hockey limits body checking to Bantam level (13-14 yo) and older
- American Academy of Pediatrics recommends to raise the age to 15 because of size discrepancy between 13 and 14 year olds
Texas 82\textsuperscript{nd} Legislature (2011-2012) HB 2038

Natasha’s Law

Requires schools/districts to have a Concussion Oversight Team (COT)

Student and parent/guardian must sign a form acknowledging concussion guidelines

If concussion suspected, student will be taken out of the game and not return to play

A student cannot return to play until cleared \textit{in writing} by the treating physician
Concussion Management Protocol Return to Play Form

This form must be completed and submitted to the athletic trainer or other person (who is not a coach) responsible for compliance with the Return to Play protocol established by the school district Concussion Oversight Team, as determined by the superintendent or their designee (see Section 38.157 (c) of the Texas Education Code).

__________________________________________  __________________________________________
Student Name (Please Print)  School Name (Please Print)

Designated school district official verifies:

Please Check

☐ The student has been evaluated by a treating physician selected by the student, their parent or other person with legal authority to make medical decisions for the student.

☐ The student has completed the Return to Play protocol established by the school district Concussion Oversight Team.

☐ The school has received a written statement from the treating physician indicating, that in the physician’s professional judgment, it is safe for the student to return to play.

__________________________________________  ______________________________
School Individual Signature  Date

__________________________________________  __________________________________________
School Individual Name (Please Print)  School Individual Signature
Texas Association of Private and Parochial Schools

Concussion Return to Play Form

Student: _______________  Date of Birth: _______________

Gender:  □ Female  □ Male  Grade Level:  □ 9th  □ 10th  □ 11th  □ 12th

School (City/School): ____________________________

Date of Injury: _______________  Activity: _______________

Date of Initial Exam: _______________

After consultation and examination, the above named student is released to return to activities as checked below. Restrictions to participation, if any, are as noted.

☐  Student may return to practice on the following date: _______________

☐  Student may return to full participation on the following date: _______________

☐  Restrictions:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Physician’s Signature / Date

________________________________________________________________________

Physician’s Name: _________________________________

Office Address: _________________________________

Office Phone: _________________________________
- Depending on the sport, encourage rule limitations and proper technique
- When in doubt, sit them out
- Return to Learn comes before Return to Play
- Schools and school districts now have a concussion policy for physician evaluation and return to play clearance.
