UPDATE ON CONCUSSIONS IN STUDENT ATHLETES: SUPPORTING THE STUDENT IN THEIR RECOVERY

COLBY HANSEN, MD
ASSOCIATE PROFESSOR
PHYSICAL MEDICINE AND REHABILITATION
UNIVERSITY OF UTAH
OUTLINE

• Review latest guidelines for concussion in sport and in student-athletes
• Principles of recovery
• Return to sport
• Return to learn
GUIDELINES UPDATE
MOST RECENT GUIDELINES OR POSITION STATEMENTS BY GROUP

• Concussion in Sport Group, ver. 5 2016
• CDC (Pediatric mTBI) 2018
• American Medical Society for Sports Medicine 2019
• National Athletic Trainers Association 2014
• American Academy of Pediatrics 2018
• American Academy of Neurology 2013
• Ontario Neurotrauma Foundation (Pediatric mTBI) 2018 (2014)
How to join

Web

Text

1. 

1.

2.

2.
New guidelines on concussion in sport place an increasing emphasis on pre-season baseline testing.
Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

1. Recognize
2. Remove
3. Re-evaluate
4. Rest
5. Rehabilitation
6. Refer
7. Recovery
8. Return to sport
9. Reconsider different populations
10. Residual effects and sequelae
11. Risk Reduction

11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Recognize
  – The use of helmet-based or other sensor systems to clinically diagnose or assess SRC cannot be supported at this time.
  – Baseline testing may be useful, but is not necessary for interpreting post-injury scores.
  – Other tools show promise as sideline screening tests but require adequately powered diagnostic accuracy studies that enroll a representative sample of athletes with suspected SRC.
11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Remove
  – Adequate facilities should be provided for the appropriate medical assessment both on and off the field for all injured athletes. In some sports, this may require rule changes to allow an appropriate off-field medical assessment to occur without affecting the flow of the game or unduly penalising the injured player’s team

• Re-evaluate
  – Advanced neuroimaging, fluid biomarkers and genetic testing are important research tools, but require further validation to determine their ultimate clinical utility in evaluation of SRC
11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Rest
  – After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active while staying below their cognitive and physical symptom-exacerbation thresholds (i.e., activity level should not bring on or worsen their symptoms). It is reasonable for athletes to avoid vigorous exertion while they are recovering. The exact amount and duration of rest is not yet well defined in the literature and requires further study.

• Rehabilitation
  – The data support interventions including psychological, cervical and vestibular rehabilitation. In addition, closely monitored active rehabilitation programmes involving controlled sub-symptom-threshold, submaximal exercise have been shown to be safe and may be of benefit in facilitating recovery.
• Refer...for persistent symptoms
  – The Berlin expert consensus is that use of the term ‘persistent symptoms’ following SRC should reflect failure of normal clinical recovery—that is, symptoms that persist beyond expected time frames (ie, >10–14 days in adults and >4 weeks in children).
  – If pharmacotherapy is used, then an important consideration in return to sport is that concussed athletes should not only be free from concussion-related symptoms, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of SRC.
11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Recovery
  – The strongest and most consistent predictor of slower recovery from SRC is the severity of a person’s initial symptoms in the first day, or initial few days, after injury.
  – Moreover, recent literature suggests that the physiological time of recovery may outlast the time for clinical recovery. The consequence of this is as yet unknown, but one possibility is that athletes may be exposed to additional risk by returning to play while there is ongoing brain dysfunction. These modalities, while useful as research tools, are not ready for clinical management.
11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Return to sport

Table 1: Graduated return-to-sport (RTS) strategy

<table>
<thead>
<tr>
<th>Stage</th>
<th>Aim</th>
<th>Activity</th>
<th>Goal of each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Symptom-limited activity</td>
<td>Daily activities that do not provoke symptoms</td>
<td>Gradual reintroduction of work/school activities</td>
</tr>
<tr>
<td>2</td>
<td>Light aerobic exercise</td>
<td>Walking or stationary cycling at slow to medium pace. No resistance training</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>3</td>
<td>Sport-specific exercise</td>
<td>Running or skating drills. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>4</td>
<td>Non-contact training drills</td>
<td>Harder training drills, eg, passing drills. May start progressive resistance training</td>
<td>Exercise, coordination and increased thinking</td>
</tr>
<tr>
<td>5</td>
<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>6</td>
<td>Return to sport</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>
11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

• Reconsider…different populations
  – Elite and non-elite athletes should be managed by the same guiding principles
  – *Children and adolescents should not return to sport until they have successfully returned to school.*

• Residual effects and sequelae
  – Clinicians need to be mindful of the potential for long-term problems such as cognitive impairment, depression, etc in the management of all athletes. However, there is **much more to learn about the potential cause-and-effect relationships of repetitive head-impact exposure and concussions**

11 ‘R’S’ OF SPORT RELATED CONCUSSION MANAGEMENT

- Risk reduction
  - Equipment
  - Rule changes
  - There is some promise that vision training in collegiate American football players may reduce SRC.
  - Psychological and sociocultural factors in sport play a significant role in the uptake of any injury-prevention strategy and require consideration.
Report From the Pediatric Mild Traumatic Brain Injury Guideline Workgroup:
Systematic Review and Clinical Recommendations for Healthcare Providers on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children

1. For children with suspected mTBI, do specific tools, as compared with a reference standard, accurately diagnose mTBI?

2. For children presenting to the ED (or other acute care setting) with mTBI, how often does routine head imaging identify important intracranial injury?

3. For children presenting to the ED (or other acute care setting) with mTBI, which features identify patients at risk for important intracranial injury?

4. For children with mTBI, what factors identify patients at increased risk for ongoing impairment, more severe symptoms, or delayed recovery (< 1 year post-injury)?

5. For children with mTBI, which factors identify patients at increased risk of long-term (≥ 1 year) sequelae?

6. For children with mTBI (with ongoing symptoms), which treatments improve mTBI-related outcomes?

OVERVIEW

- 19 sets of recommendations on diagnosis, prognosis, and management/treatment of pediatric mTBI.
- Each recommendation was assigned a level of obligation (i.e., must, should, or may) based on confidence in the evidence.
Get out your pencils...
DIAGNOSTIC RECOMMENDATIONS

• 1A: Health care professionals should not routinely obtain head CT for diagnostic purposes

• 1B: Health care professionals should use validated clinical decision rules to identify children with mTBI that may warrant head CT
DIAGNOSTIC RECOMMENDATIONS

• 1C: For children diagnosed as having mTBI, health care professionals should discuss the risks of pediatric head CT in the context of risk factors for ICI with the patient and his/her family
DIAGNOSTIC RECOMMENDATIONS

• 2: Health care professionals should not routinely use MRI in the acute evaluation of suspected or diagnosed mTBI

• 3: Health care professionals should not use single photon emission CT (SPECT) in the acute evaluation of suspected or diagnosed mTBI
DIAGNOSTIC RECOMMENDATIONS

• 4A: Skull radiographs should not be used in the diagnosis of pediatric mTBI
• 4B: Skull radiographs should not be used in the screening for ICI
DIAGNOSTIC RECOMMENDATIONS

• 5A: Health care professionals should use an age appropriate, validated symptom rating scale as a component of the diagnostic evaluation in children seen with acute mTBI

• 5B: Health care professionals may use validated, age-appropriate computerized cognitive testing in the acute period of injury as a component of the diagnosis of mTBI

• 5C: The Standardized Assessment of Concussion should not be exclusively used to diagnose mTBI in children aged 6 to 18 years
DIAGNOSTIC RECOMMENDATIONS

• 6: Health care professionals should not use biomarkers outside of a research setting for the diagnosis of children with mTBI
PROGNOSTIC RECOMMENDATIONS

• 7A: Health care professionals should counsel patients and families that most (70%-80%) children with mTBI do not show significant difficulties that last more than 1 to 3 months after injury.

• 7B: Health care professionals should counsel patients and families that, although some factors predict an increased or decreased risk for prolonged symptoms, each child’s recovery from mTBI is unique and will follow its own trajectory.
PROGNOSTIC RECOMMENDATIONS

• 8A: Health care professionals should assess the premorbid history of children either before injury as a part of preparticipation athletic examinations or as soon as possible after injury to assist in determining prognosis.
PROGNOSTIC RECOMMENDATIONS

8B: Health care professionals should counsel children and families completing preparticipation athletic examinations and children with mTBI, as well as their families, that recovery from mTBI might be delayed in those with the following:

- Premorbid histories of mTBI
- Lower cognitive ability (for children with an intracranial lesion)
- Neurological or psychiatric disorder
- Learning difficulties
- Increased preinjury symptoms (ie, similar to those commonly referred to as “postconcussive”)
- Family and social stressors
PROGNOSTIC RECOMMENDATIONS

• 9A: Health care professionals should screen for known risk factors for persistent symptoms in children with mTBI

• 9B: Health care professionals may use validated prediction rules, which combine information about multiple risk factors for persistent symptoms, to provide prognostic counseling to children with mTBI evaluated in ED settings
PEDIATRIC PCS – PREDICTORS?

- Clinical Risk Score Derivation and Validation
- >3000 children presenting to ER within 48 hours of head injury
- ~30% with PCS at 4 weeks
- Variables of potential significance analyzed in bivariable fashion, checked for interrater agreement, then put in a multivariate model to create a prediction score for PCS

JAMA. 2016;315(10):1014-1025
PEDiATRiC PCS – PReDICTORS?

- 47 potential variables associated with PCS in bivariable analysis
- Excellent interrater agreement
- Multivariable model:

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Prior concussion &gt;1 week symptoms</th>
<th>Migraine Hx (physician diagnosed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache (current)</td>
<td>Noise sensitivity</td>
<td>Fatigue</td>
<td>Answering Questions slowly (symptom)</td>
</tr>
<tr>
<td>Abnormal Tandem Stance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

JAMA. 2016;315(10):1014-1025
prior to adoption into routine practice, the risk stratification score has the potential to individualize concussion care through optimal symptom management and appropriate follow-up.

Therefore, future research needs to determine if the moderate test characteristics of the PPCS risk score allow for clinicians to confidently provide reassurance, alter management plans, or both. Future clinical benefits might include identifying high-risk individuals for further screening, prioritization for specialized concussion evaluations, and initiation of emerging treatments to prevent PPCS.

Table 6. Risk Categories for Persistent Postconcussive Symptoms (PPCS) in the Derivation Cohort

<table>
<thead>
<tr>
<th>PPCS Risk Category</th>
<th>Total No. of Risk Points</th>
<th>Estimated Risk of PPCS, % (95% CI)</th>
<th>No. With PPCS/Total No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0</td>
<td>4.1 (2.4-6.7)</td>
<td>0/6 (0)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>5.8 (3.9-9.5)</td>
<td>6/37 (16.2)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>8.3 (6.0-13.2)</td>
<td>11/98 (11.2)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11.8 (8.5-17.8)</td>
<td>15/165 (9.1)</td>
</tr>
<tr>
<td>Medium</td>
<td>4</td>
<td>16.4 (11.9-22.4)</td>
<td>41/239 (17.2)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>22.3 (16.7-29.7)</td>
<td>71/289 (24.6)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>29.7 (22.7-37.9)</td>
<td>90/299 (30.1)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>38.2 (30.1-46.9)</td>
<td>96/243 (39.5)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>47.6 (38.9-57.1)</td>
<td>80/172 (46.5)</td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>57.1 (48.2-65.6)</td>
<td>58/103 (56.3)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>66.1 (57.2-74.4)</td>
<td>30/43 (69.8)</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>74.1 (65.8-81.5)</td>
<td>9/13 (69.2)</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>80.8 (74.6-88.3)</td>
<td>3/3 (100)</td>
</tr>
</tbody>
</table>

Table 5. Selected Predictor Variables for Multivariable Model of Persistent Postconcussive Symptoms (PPCS) at 28 Days in the Derivation Cohort

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>No. of Risk Points</th>
<th>Odds Ratio (95%CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-7</td>
<td>0</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>8-12</td>
<td>1</td>
<td>1.54 (1.09-2.19)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>13-&lt;18</td>
<td>2</td>
<td>2.31 (1.62-3.32)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>2.24 (1.78-2.82)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prior concussion and symptom duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No prior concussion; symptom duration &lt;1 wk</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.01</td>
</tr>
<tr>
<td>Prior concussion; symptom duration ≥1 wk</td>
<td>1</td>
<td>1.53 (1.10-2.13)</td>
<td></td>
</tr>
<tr>
<td>Physician-diagnosed migraine history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.001</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>1.73 (1.24-2.43)</td>
<td></td>
</tr>
<tr>
<td>Answering questions slowly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.008</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>1.37 (1.08-1.74)</td>
<td></td>
</tr>
<tr>
<td>Balance Error Scoring System tandem stance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-3</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.02</td>
</tr>
<tr>
<td>≥4 or Physically unable to undergo testing</td>
<td>1</td>
<td>1.31 (1.04-1.66)</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.01</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>1.66 (1.11-2.48)</td>
<td></td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1 [Reference]</td>
<td>.002</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>1.47 (1.15-1.87)</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1 [Reference]</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>1.84 (1.37-2.46)</td>
<td></td>
</tr>
</tbody>
</table>
**PPCS indicates persistent postconcussive symptoms. The area under the curve (AUC) for the risk model was 0.71 (95% CI, 0.69-0.74) for the derivation cohort and 0.68 (95% CI, 0.65-0.72) for the validation cohort.**

**Figure 2. Receiver Operating Characteristic Curves**

- **Risk Model**
  - AUC .70
- **Physician Prediction Alone**
  - AUC .55
- **Reference:**
  - 1.0  Perfect test
  - 0.9 to 0.99  Excellent test
  - 0.8 to 0.89  Good test
  - 0.7 to 0.79  Fair test
  - 0.5 to 0.69  Poor test
  - 0.5  Worthless test

**Table 7. Physicians’ Prediction at Time of Emergency Department Visit**

<table>
<thead>
<tr>
<th>Total No. of Patients (%</th>
<th>No. With PPCS/Total</th>
<th>Physicians’ prediction alone</th>
<th>Sensitivity, %</th>
<th>Specificity, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>194/718 (27.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>96/282 (34.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>48/117 (41.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-70</td>
<td>12/24 (50.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71-90</td>
<td>6/11 (54.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>91-100</td>
<td>3/5 (60.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROGNOSTIC RECOMMENDATIONS

• 10A: Health care professionals should use a combination of tools to assess recovery in children with mTBI
• 10B: Health care professionals should use validated symptom scales to assess recovery in children with mTBI
• 10C: Health care professionals may use validated cognitive testing (including measures of reaction time) to assess recovery in children with mTBI
• 10D: Health care professionals may use balance testing to assess recovery in adolescent athletes with mTBI
PROGNOSTIC RECOMMENDATIONS

• 11A: Health care professionals should closely monitor children with mTBI who are determined to be at high risk for persistent symptoms based on their premorbid history, demographics, and/or injury characteristics.

• 11B: For children with mTBI whose symptoms do not resolve as expected with standard care (ie, within 4-6 weeks), health care professionals should provide or refer for appropriate assessments and/or interventions.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 12: In providing education and reassurance to the family, the health care professional should include the following information:
  – Warning signs of more serious injury
  – Description of injury and expected course of symptoms and recovery
  – Instructions on how to monitor postconcussive symptoms
  – Prevention of further injury
  – Management of cognitive and physical activity/rest
  – Instructions regarding return to play/recreation and school
  – Clear clinician follow-up instructions
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 13A: Health care professionals should counsel patients to observe more restrictive physical and cognitive activity during the first several days after mTBI in children

• 13B: Following these first several days, health care professionals should counsel patients and families to resume a gradual schedule of activity that does not exacerbate symptoms, with close monitoring of symptom expression (number and severity)
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 13C: After the successful resumption of a gradual schedule of activity, health care professionals should offer an active rehabilitation program of progressive reintroduction of noncontact aerobic activity that does not exacerbate symptoms, with close monitoring of symptom expression (number and severity)

• 13D: Health care professionals should counsel patients to return to full activity when they return to premorbid performance if they have remained symptom free at rest and with increasing levels of physical exertion
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 14: Health care professionals may assess the extent and types of social support (ie, emotional, informational, instrumental, and appraisal) available to children with mTBI and emphasize social support as a key element in the education of caregivers and educators.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 15A: To assist children returning to school after mTBI, medical and school-based teams should counsel the student and family regarding the process of gradually increasing the duration and intensity of academic activities as tolerated, with the goal of increasing participation without significantly exacerbating symptoms.

• 15B: Return-to-school protocols should be customized based on the severity of postconcussion symptoms in children with mTBI as determined jointly by medical and school-based teams.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 15C: For any student with prolonged symptoms that interfere with academic performance, school-based teams should assess the educational needs of that student and determine the student’s need for additional educational supports, including those described under pertinent federal statutes (e.g., Individuals With Disabilities Education Act 504)

• 15D: Postconcussion symptoms and academic progress in school should be monitored collaboratively by the student, family, health care professional(s), and school teams, who jointly determine what modifications or accommodations are needed to maintain an academic workload without significantly exacerbating symptoms
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 15E: The provision of educational supports should be monitored and adjusted on an ongoing basis by the school based team until the student’s academic performance has returned to preinjury levels.

• 15F: For students who demonstrate prolonged symptoms and academic difficulties despite an active treatment approach, health care professionals should refer the child for a formal evaluation by a specialist in pediatric mTBI.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 16A: Health care professionals in the ED should clinically observe and consider obtaining a head CT in children seen with severe headache, especially when associated with other risk factors and worsening headache after mTBI, to evaluate for ICI requiring further management in accord with validated clinical decision making rules

• 16B: Children undergoing observation periods for headache with acutely worsening symptoms should undergo emergent neuroimaging
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 16C: Health care professionals and caregivers should offer nonopioid analgesia (ie, ibuprofen or acetaminophen) to children with painful headache after acute mTBI but also provide counseling to the family regarding the risks of analgesic overuse, including rebound headache.

• 16D: Health care professionals should not administer 3% hypertonic saline to children with mTBI for treatment of acute headache outside of a research setting at this time.

• 16E: Chronic headache after mTBI is likely to be multifactorial; therefore, health care professionals should refer children with chronic headache after mTBI for multidisciplinary evaluation and treatment, with consideration of analgesic overuse as a contributory factor.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 17: Health care professionals may refer children with subjective or objective evidence of persistent vestibulo-oculomotor dysfunction after mTBI to a program of vestibular rehabilitation.
MANAGEMENT/TREATMENT RECOMMENDATIONS

- 18A: Health care professionals should provide guidance on proper sleep hygiene methods to facilitate recovery from pediatric mTBI.
- 18B: If sleep problems emerge or continue despite appropriate sleep hygiene measures, health care professionals may refer children with mTBI to a sleep disorder specialist for further assessment.
MANAGEMENT/TREATMENT RECOMMENDATIONS

• 19A: Health care professionals should attempt to determine the etiology of cognitive dysfunction within the context of other mTBI symptoms

• 19B: Health care professionals should recommend treatment for cognitive dysfunction that reflects its presumed etiology

• 19C: Health care professionals may refer children with persisting problems related to cognitive function for a formal neuropsychological evaluation to assist in determining the etiology and recommending targeted treatment
Of the 19 guidelines for assessing and managing mTBI in children, how many are you currently doing on a consistent basis?
Principles of Recovery
“When in doubt, sit them out”
The best advice for a person who sustained a concussion 3 weeks ago and is still not feeling well is...

- Rest until your symptoms go away
- Just go back to your usual stuff (work, play, etc.) it’s ‘all in your head’
- Take some melatonin and come back and see me in a couple weeks
- Go see a psychologist
- Learn how to pace yourself, try to be active including exercise and some work/school activities
The best advice for a person who sustained a concussion 3 weeks ago and is still not feeling well is...

Poll locked. Responses not accepted.

- Rest until your symptoms go away
- Just go back to your usual stuff (work, play, etc.) it’s ‘all in your head’
- Take some melatonin and come back and see me in a couple weeks
- Go see a psychologist
- Learn how to pace yourself, try to be active including exercise and some work/school activities

Total Results: 0
The best advice for a person who sustained a concussion 3 weeks ago and is still not feeling well is...

Poll locked. Responses not accepted.

- Rest until your symptoms go away
- Just go back to your usual stuff (work, play, etc.) it’s ‘all in your head’
- Take some melatonin and come back and see me in a couple weeks
- Go see a psychologist
- Learn how to pace yourself, try to be active including exercise and some work/school activities
MANAGEMENT

• Rest
• Activity
• Return to Learn
• Return to Play
• Time and timing
REST VS. ACTIVITY
PROMOTING RECOVERY

• Early…while still symptomatic
  – Educate on natural history, what to expect
  – REST, REST, REST PACE, PACE, PACE
  – Physical Rest
    • Stick to basic ADLs
  – Cognitive Rest
    • Consider time off school, either complete or partial
    • Other school accommodations:
      – Limit or delay test taking
      – Incorporate breaks into day
      – Encourage parent to speak up!
      – Limit Homework
      – Provide notes for class
      – Involve counselor/admin
PROMOTING RECOVERY

• Gradually reintroduce activities as symptoms abate
• High yield therapeutic targets:
  – Sleep management
  – Headache management
• Treat other comorbid issues as necessary (i.e. Physical Therapy for neck issues)
• Exercise...at the right time
EXERCISE IS BENEFICIAL – THE LATEST IN A GROWING BODY OF LITERATURE

• Subthreshold Aerobic Exercise early after injury
• Don’t confuse return to play with return to exercise

YOUR BOTTOM LINE

- Balancing rest vs activity is key
- Pace, pace, pace
- Return to exercise ≠ Return to sport
Managing Return to Learn and Play
MINIMUM CRITERIA FOR RETURNING TO PLAY

• Question: When can my kid go back to play?

• Answer: When they are completely recovered.
  – Reported symptom burden
  – School performance
  – Exercise tolerance
  – Normal exam (balance)
  – Normal cognition
Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

# GRADUATED RETURN TO PLAY

<table>
<thead>
<tr>
<th>Rehabilitation Stage</th>
<th>Functional Exercise at each stage</th>
<th>Objective at each stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Activity</td>
<td>Complete physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>Light Aerobic Exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity, 70% MPHR; no resistance training</td>
<td>Increase HR</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>
TAKE HOME POINTS – PEDIATRIC SPECIFIC

• Graduated Return to Play Protocol re-emphasized
• At least 24 hours to pass between stages
• Children and adolescents should not return to sport until they have successfully returned to school.
• Pediatric population recognized as a unique group that may require longer period of time to recovery prior to returning to contact sports
• “A more conservative return to play approach is recommended”
• “It is appropriate to extend the amount of time of asymptomatic rest and/or the length of the graded exertion in children and adolescents”

SCHOOL ISSUES - “RETURN TO LEARN”

• Rationale for graduated return to school is similar in concept to returning to physical activities and sports
• Concussed patients frequently experience worsened symptoms with mental exertion and high stimulation environments
• The right pace to resumption of school work is key to helping manage symptoms and provide a successful outcome
## RETURN TO SCHOOL STRATEGY - EXAMPLE

<table>
<thead>
<tr>
<th>Stage</th>
<th>Aim</th>
<th>Activity</th>
<th>Goal of each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Daily activities at home that do not give the child symptoms</td>
<td>Typical activities of the child during the day as long as they do not increase symptoms (e.g., reading, texting, screen time). Start with 5–15 min at a time and gradually build up</td>
<td>Gradual return to typical activities</td>
</tr>
<tr>
<td>2</td>
<td>School activities</td>
<td>Homework, reading or other cognitive activities outside of the classroom</td>
<td>Increase tolerance to cognitive work</td>
</tr>
<tr>
<td>3</td>
<td>Return to school part-time</td>
<td>Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day</td>
<td>Increase academic activities</td>
</tr>
<tr>
<td>4</td>
<td>Return to school full time</td>
<td>Gradually progress school activities until a full day can be tolerated</td>
<td>Return to full academic activities and catch up on missed work</td>
</tr>
</tbody>
</table>

## Table 2: Gradual return to academics

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Activity Level</th>
<th>Criteria to Move to Next Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No return, at home</td>
<td>Maintain low level cognitive and physical activity; no prolonged concentration</td>
<td>1. Student can sustain concentration for 30 minutes before significant symptom exacerbation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cognitive readiness challenge: as symptoms improve, try reading or math challenge task for 10–30 minutes; assess for symptom increase</td>
<td>2. Symptoms reduce or disappear with cognitive rest breaks, allowing the student to return to the activity</td>
</tr>
<tr>
<td>1</td>
<td>Return to school, partial day (1–3 hours)</td>
<td>Attend 1–3 classes, with interspersed rest breaks; minimal expectations for productivity; no tests or homework</td>
<td>Student’s symptoms are improving, able to tolerate 4–5 hours of activity with 2–3 cognitive rest breaks built into school day</td>
</tr>
<tr>
<td>2</td>
<td>Full day; maximal supports (maximal supports needed throughout day)</td>
<td>Attend most classes, with 2–3 rest breaks (20–30 minutes); no tests; minimal homework (&lt;50 minutes); minimal–moderate expectations for productivity</td>
<td>Number and severity of symptoms improving, and needs only 1–2 cognitive rest breaks built into school day</td>
</tr>
<tr>
<td>3</td>
<td>Full day; moderate supports (moderate supports provided in response to symptoms during the day)</td>
<td>Attend all classes with 1–2 rest breaks (20–30 minutes); begin quizzes; moderate homework (60–90 minutes); moderate expectations for productivity; design schedule for make-up work</td>
<td>Continued symptom improvement, and needs no more than 1 cognitive rest break per day</td>
</tr>
<tr>
<td>4</td>
<td>Full day; minimal supports (monitoring final recovery)</td>
<td>Attend all classes with 0–1 rest breaks (20–30 minutes); begin modified tests (with breaks and/or extra time, if needed); normal homework schedule (90 + minutes); moderate–maximum expectations for productivity</td>
<td>No active symptoms throughout the school day</td>
</tr>
<tr>
<td>5</td>
<td>Full return, no supports needed</td>
<td>Full class schedule, no rest breaks; maximum expectations for productivity; begin to address make-up work</td>
<td>—</td>
</tr>
</tbody>
</table>
UNDERSTANDING THE SYSTEM

• Physicians cannot mandate to schools what to do
• Layers of support
  – Informal accommodations (most frequent)
  – 504 plan (support in a regular classroom setting)
  – IEP (supplemental services beyond the scope of the general curriculum)
• School districts may have ‘Brain Injury Teams’ to help coordinate more involved plans such as IEPs
  – May encourage parents to seek out this support if school is being difficult to work with
KEY COMPONENTS

• Educating patients, parents, school personnel on symptoms to be observant of
  – Increased problems with paying attention, concentrating, remembering, or learning new information
  – Longer time needed to complete tasks or assignments
  – Greater irritability, less able to cope with stress
  – Symptoms worsen (e.g., headache, tiredness) when doing schoolwork
KEY COMPONENTS

• Empowering parents to advocate for services/accommodations for their child
  – Provide a letter of academic accommodation
  – Encouraging parents to meet with school personnel to discuss options
• Flexibility with the plan
# POTENTIAL SCHOOL ACCOMMODATIONS

<table>
<thead>
<tr>
<th>Accommodation</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excused absence from class</td>
<td>Several days of complete rest, progressing to limited attendance, may be needed</td>
</tr>
<tr>
<td>Rest periods during the school day</td>
<td>When symptoms flare, brief rest and pain medication may allow student to return to class</td>
</tr>
<tr>
<td>Extension of assignment deadlines</td>
<td>Information-processing speed and ability to handle full workload may be impeded</td>
</tr>
<tr>
<td>Postponement or staggering of tests</td>
<td>Mental effort to prepare and then take test may worsen symptoms</td>
</tr>
<tr>
<td>Excuse from (or delay of) specific tests and assignments</td>
<td>Relieves emotional pressure and allows return to regular workload as soon as possible</td>
</tr>
<tr>
<td>Extended testing time</td>
<td>Information processing may be impeded</td>
</tr>
<tr>
<td>Accommodation for light or noise sensitivity</td>
<td>Fluorescent light and high-stimulation environments may cause symptoms</td>
</tr>
<tr>
<td>Excuse from team sports practice and gym activities</td>
<td>No physical activity progresses to limited physical activity, as tolerated</td>
</tr>
<tr>
<td>Monitor backpack weight, stair use, playing of wind instruments</td>
<td>Avoidance of other physical exertion</td>
</tr>
<tr>
<td>Use of a reader or recorded books for assignments and testing</td>
<td>Lessens visual scanning and concentration demands</td>
</tr>
<tr>
<td>Use of a note taker or scribe</td>
<td>Lessens attentional, visual, and concentration demands</td>
</tr>
<tr>
<td>Use of a smaller, quieter examination room</td>
<td>Lessens stimulation and distraction</td>
</tr>
<tr>
<td>Preferential classroom seating</td>
<td>Lessens distraction</td>
</tr>
<tr>
<td>Temporary assistance of a tutor</td>
<td>Assists in organizing and prioritizing assignments</td>
</tr>
</tbody>
</table>

*Adapted with permission from McGrath.*

# POTENTIAL SCHOOL ACCOMMODATIONS

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Functional School Problem</th>
<th>Accommodation or Management Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention or Concentration</strong></td>
<td>Short focus on lecture, classwork, homework</td>
<td>Shorter assignments, break down tasks, lighter work load</td>
</tr>
<tr>
<td><strong>Working Memory</strong></td>
<td>Holding instructions in mind, reading comprehension, math calculation, writing</td>
<td>Repetition, written instructions, use of calculator, short reading passages</td>
</tr>
<tr>
<td><strong>Memory Consolidation or Retrieval</strong></td>
<td>Retaining new information, accessing learned info when needed</td>
<td>Smaller amounts to learn, recognition cues</td>
</tr>
<tr>
<td><strong>Processing Speed</strong></td>
<td>Keep pace with work demand, process verbal information effectively</td>
<td>Extended time, slow down verbal info, comprehension-checking effectively</td>
</tr>
<tr>
<td><strong>Cognitive Fatigue</strong></td>
<td>Decreased arousal or activation, to engage basic attention, working memory</td>
<td>Rest breaks during classes, homework, and examinations</td>
</tr>
<tr>
<td><strong>Anxiety</strong></td>
<td>Interferes with concentration; student may push through symptoms to prevent falling behind</td>
<td>Reassurance from teachers and team about accommodations; workload reduction, alternate forms of testing</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Symptom</th>
<th>Functional School Problem</th>
<th>Accommodation or Management Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depression or Withdrawal</strong></td>
<td>withdrawal from school or friends due to stigma or activity restrictions</td>
<td>Engage student with friends at lunch or recess, build in time for socialization</td>
</tr>
<tr>
<td><strong>Irritability</strong></td>
<td>Poor tolerance for stress, alternate peers or teachers</td>
<td>Reduce stimulation and stressors, provide rest breaks</td>
</tr>
<tr>
<td><strong>Headaches</strong></td>
<td>Interferes with concentration, increased irritability</td>
<td>Rest breaks, short nap</td>
</tr>
<tr>
<td><strong>Light or Noise Sensitivity</strong></td>
<td>Symptoms worse in bright or loud environments</td>
<td>Temporarily wear sunglasses, avoiding bright sunlight or other light; avoid noisy or crowded environments such as lunchrooms, assemblies, and hallways</td>
</tr>
<tr>
<td><strong>Dizziness or Balance Problems</strong></td>
<td>Unsteadiness when walking</td>
<td>Elevator pass, class transition before bell</td>
</tr>
<tr>
<td><strong>Sleep Disturbance</strong></td>
<td>Decreased arousal, shifted sleep schedule</td>
<td>Later start time, shortened day</td>
</tr>
<tr>
<td><strong>Symptom Sensitivity (hallucinatory effects)</strong></td>
<td>Symptoms worsen with overactivity, resulting in any of the previously listed problems</td>
<td>Reduce cognitive or physical demands below symptom threshold; provide rest breaks; complete work in small increments until symptom threshold increases</td>
</tr>
</tbody>
</table>
YOUR BOTTOM LINE

• Address return to learn in all of your management plans, **Provide a letter or form**
• Encourage plan to be flexible/adaptable
• The best plan on paper doesn’t do a bit of good if not implemented in the classroom – encourage persistence
• Don’t ever clear a student athlete to return to sport if they haven’t successfully returned to the classroom
What one lesson or idea will you take away from this talk?