Concussion – Epidemiology and Current Guidelines

Aaron Provance MD
Sports Medicine Program for Young Athletes
Epidemiology

• 38 million children and adolescents participate in organized sports in the United States
• 170 million adults participate in physical activities, including sports
• 1.6 to 3.8 million concussions occur in sports and recreational activities annually
• Vastly underestimated with so many underreported

The Epidemiology of Sport-Related Concussion
Epidemiology

• Rate of concussion has been increasing steadily over the past two decades
• Improvement in the detection of concussion
• Increase in the true number of concussive impacts?
• Are athletes just getting bigger, stronger, and faster?
• Higher risk of concussion in competition as compared to practice (higher number occur in practice)
• Within a given sport, females tend to report higher rates of concussion than males

The Epidemiology of Sport-Related Concussion
Incidence of Head and Neck Injuries in Extreme Sports

Vinay K. Sharma, Juan N. Rango, BS, Alexander Connaughton, Vani J. Sabesan, MD

- Presented at the AAOS 2014 Annual Meeting
- 2000-2011 National Electronic Injury Surveillance System was used to acquire data for seven popular sports that are included in the Winter and Summer X games
- 4 million injuries reported between 2000-2011, 11.3% were head and neck injuries
Incidence of Head and Neck Injuries in Extreme Sports

Vinay K. Sharma, Juan N. Rango, BS, Alexander Connaughton, Vani J. Sabesan, MD

- 83% were head injuries and 17% neck injuries
- Highest Rates: Skateboarding (129,600), snowboarding (97,527), skiing (83,313) and motocross (78,236)
- Of these, 2.5% were considered severe (cervical or skull fracture)
- Doing the math = comes out to over 1000 severe head and neck injuries per year
What’s New?

Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012

Postural stability assessment
Timing of “rehabilitation”
Chronic traumatic encephalopathy (CTE)
New Tools
  Sport Concussion Assessment Tool revision (SCAT3)
  Child SCAT3
  Concussion Recognition Tool (CRT) for lay use
Outputs

Co-Publication Spring 2013:

BJSM
CJSM
Journal of Athletic Training
Journal of Clinical Neuroscience
Journal of Science & Medicine in Sport
American Journal of Physical Medicine and Rehabilitation
Scandinavian Journal of Science and Medicine in Sport
South African Journal of Sport Medicine
Journal of American College of Surgeons
Definitions

Traumatic Brain Injury

“Minimal”

Mild

Mod

Severe

Sports concussion

Glasgow Coma Scale
“Concussion is a brain injury and is defined as a complex pathophysiologic process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include…”
Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However in some cases symptoms and signs may evolve over a number of minutes to hours.”
Investigations

Neuroimaging (CT, MRI)

*Contributes little to concussion evaluation*

Use when suspicion of intracerebral or structural lesion exists:
- focal neurologic deficit
- worsening symptoms
- prolonged disturbance of conscious state

Other modalities such as fMRI correlate with symptom severity and recovery and although not routinely used presently *may* provide additional insight

Alternative imaging technologies are still at early stage of development in concussion and *not* recommended other than research setting
Investigations

Postural stability testing - deficits 72hr post concussion
- Balance error scoring system (BESS), force plate technology

Genetic testing/markers
- Significance unclear for Apolipoprotein (Apo) E4 and other genetic factors
- Insufficient evidence for routine clinical use
**Investigations**

**Neuropsychological (NP) Assessment**

Important component in overall assessment and RTP.

**Should NOT be sole basis of management decisions, but an aid to clinical decision making.**

Included as part of clinical neurological assessment by treating physician often with computerized NP screening tools.

Formal NP testing not required for all but, if so, interpretation should be performed by trained neuropsychologist.

Best done when asymptomatic but may be advantageous at other stages in particular situations.

**Baseline testing not mandatory.** May be helpful in test interpretation and for education opportunity.
Management

CORNERSTONE = initial period of rest until acute symptoms resolve

Physical Rest
No training, playing, exercise, weights
Beware of exertion with activities of daily living

Cognitive Rest
No television, extensive reading, video games?
Caution: daytime sleep
Recovered?

Everyone “feels fine”

Always ask:

1. “On a scale of 0 to 100%, how do you feel?”
2. “what makes you not 100%?”
3. Symptom Checklist – SCAT3
Graduated 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>1. No activity</td>
<td>Symptom limited physical and cognitive rest.</td>
<td>Recovery</td>
</tr>
<tr>
<td>2. Light aerobic exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity &lt; 70% MPHR No resistance training.</td>
<td>Increase HR</td>
</tr>
<tr>
<td>3. 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>4. Non-contact training drills</td>
<td>Progression to more complex training drills e.g. passing drills in football and ice hockey. May start progressive resistance training</td>
<td>Exercise, coordination, and cognitive load</td>
</tr>
<tr>
<td>5. 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. Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>
Same day return to play?

NO!

Unanimously agreed that no RTP should occur on the day of concussive injury.
Special Populations

Child and Adolescent Athlete
Elite vs non-elite
CTE
Child and Adolescent Athlete

Adult recommendations can apply down to age 13. Below 13 require age appropriate symptom checklists and evaluation tool.

child SCAT3 developed for this purpose

Include both patient and parent, teacher and school input.
Possibly use neuropsych testing before symptoms resolve to assist planning school management.

must be developmentally sensitive, consider use of trained pediatric neuropsychologist
Elite vs non-elite

All athletes should be managed the same regardless of level of participation.

Available resources and expertise may determine management approaches.

Consider cognitive evaluation in all organized high-risk sports regardless of age or level of performance.
Chronic traumatic encephalopathy (CTE)

Acknowledge potential for long-term problems in all athletes

CTE unknown incidence in athletic populations, cause/effect not yet demonstrated between CTE and concussions or exposure to contact sport
Other Issues

Prevention

Protective equipment

Mouth guards have benefit in prevention oral injury, but no evidence of concussion reduction.

Head gear and helmets show reduction in biomechanical forces, but have not translated to a reduction in concussion incidence.

Helmets reduce head and facial injury in skiing and snowboarding and are recommended for alpine sports.

Helmets reduce other forms of head injury (e.g. fracture) in cycling, equestrian, motor sports.
THANK YOU!