Treatment and Rehabilitation for Persistent Post-Concussion Symptoms

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Some people who sustain head trauma (with or without brain injury) report symptoms weeks, months, and years following the injury.
Are long-term symptoms caused by the original injury, other factors, or both?
Terminology Matters and Might Vary From Case to Case and Provider to Provider

• Persistent Symptoms
• Symptoms
• Post-Concussion Symptoms
• Post-Concussion Syndrome
• Post-Concussive Disorder
The symptoms of mild TBI can be mimicked or magnified by traumatic stress, anxiety, pain, depression, sleep disturbance, and social psychological factors at any point during recovery.
Whether or not the Post-Concussion Syndrome or “Disorder” is a true syndrome has been discussed and debated for more than 100 years.
What is it?

• A neurological syndrome?

• A psychiatric syndrome or disorder?

• A neuropsychiatric syndrome or disorder?

• A set of symptoms and problems, with diverse underlying causes, that occur following trauma to the head and neck?
ICD-10 Criteria for Postconcussional Syndrome

• Must endorse symptoms in at least 3 domains
  – Physical
  – Emotional
  – Cognitive
  – Insomnia
  – Excessive worry over symptoms
  – Intolerance for alcohol
• Physical Symptoms (headache, dizziness, balance problem, noise sensitive, light sensitive, and/or fatigue)

• Emotional Symptoms (irritability, sadness, nervousness, and/or feeling more emotional),

• Cognitive Symptoms (poor concentration, poor memory); and

• Insomnia (trouble falling asleep and/or sleeping less than usual).
Post-Concussion Syndrome

• More common in women than men.

• Pre-injury mental health problems are a major risk factor.

• It is associated with or influenced by traumatic stress in service members, veterans, and civilians.

• Persistent symptoms at 1 or 3 months are a risk factor for persistent symptoms at 1 year.

• Easy to misdiagnose in people with depression, anxiety, PTSD, and chronic pain.
Persistent Symptoms

Pain, Anxiety, & Depression
Civilians who sustain an MTBI are at substantially increased risk for experiencing depression in the first year following injury.

The etiology of depression is likely individualized and multifactorial.
Post-concussion-like symptoms can be mimicked or magnified by traumatic stress, anxiety, pain, depression, sleep disturbance, and social psychological factors at any point in the recovery trajectory.
Pain Can Influence Subjectively and Objectively Measured Cognition

- **Subjective**: Those with chronic pain frequently report problems with cognition, such as attention and memory difficulties.

- **Objective**: As a group, they perform more poorly on neuropsychological testing.
Pain-Cognition Mechanisms

- Emotional Distress / Anxiety
- Depression (frequently co-morbid with chronic pain)
- Medication Side Effects
- Chronic Sleep Difficulties
Anxiety

1. Pre-existing Generalized Anxiety Disorder: Some people perform more poorly on NP testing (as a stable, pre-existing finding).

2. Stable or situational anxiety can influence performance on testing (i.e., as a temporary situational factor that is distracting).

3. Anxiety symptoms can mimic post-concussion symptoms (e.g., concentration difficulty, irritability, sleep problems, dizziness, fatigue, etc.)
Depression

1. Some people perform more poorly on NP testing.

2. Can be associated with decreased motivation or “enthusiasm” for cognitive testing.

3. Depression can mimic post-concussion symptoms (e.g., headaches, concentration difficulty, irritability, sleep problems, dizziness, fatigue, etc.).

4. The vast majority of patients with depression will report a constellation of symptoms similar to a post-concussion syndrome.
Individuals who are symptomatic at 3-6 months are at considerable risk for being symptomatic at 1-2 years post injury.
Social-Psychological Factors

Good Old Days Bias
“GOOD OLD DAYS” BIAS FOLLOWING MILD TRAUMATIC BRAIN INJURY

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Good Old Days Bias

• The tendency to view oneself as healthier in the past and under-estimate past problems is referred to as the “good old days” bias.

• Researchers have reported that some patients with a history of MTBI and/or who are involved in litigation report fewer symptoms and problems than healthy adult control subjects.
Retrospective vs. Current Symptom Ratings

- Worker’s Compensation patients with Post-Concussion Syndrome (N=90) asked to retrospectively rate their pre-injury symptoms.

- Healthy controls and university students (N=177) asked to rate their current symptoms.

Iverson, Lange, Brooks, & Ashton (2010)
Pre-Injury Retrospective Symptom Reporting vs. Current Symptom Reporting (M and SD on the BC-PSI)

WCB PCS: Pre-Injury

- 2

Community Controls

- 6.2
Non-Specificity of Post-Concussion Symptoms
Factors Associated With Concussion-like Symptom Reporting in High School Athletes

Grant L. Iverson, PhD; Noah D. Silverberg, PhD; Rebekah Mannix, MD, MPH; Bruce A. Maxwell, PhD; Joseph E. Atkins, PhD; Ross Zafonte, DO; Paul D. Berkner, DO

IMPORTANCE Every state in the United States has passed legislation for sport-related concussion, making this health issue important for physicians and other health care professionals. Safely returning athletes to sport after concussion relies on accurately determining when their symptoms resolve.

OBJECTIVE To evaluate baseline concussion-like symptom reporting in uninjured adolescent student athletes.

DESIGN, SETTING, AND PARTICIPANTS In this cross-sectional, observational study, we studied 31,958 high school athletes from Maine with no concussion in the past 6 months who completed a preseason baseline testing program between 2009 and 2013.

RESULTS Symptom reporting was more common in girls than boys. Most students with preexisting conditions reported one or more symptoms (60%-82% of boys and 73%-97% of girls). Nineteen percent of boys and 28% of girls reported having a symptom burden resembling an International Classification of Diseases, 10th Revision (ICD-10) diagnosis of postconcussional syndrome (PCS). Students with preexisting conditions were even more likely to endorse a symptom burden that resembled PCS (21%-47% for boys and 33%-72% for girls). Prior treatment of a psychiatric condition was the strongest independent predictor for symptom reporting in boys, followed by a history of migraines. For girls, the strongest independent predictors were prior treatment of a psychiatric condition or substance abuse and attention-deficit/hyperactivity disorder. The weakest independent predictor of symptoms for both sexes was history of prior concussions.

CONCLUSIONS AND RELEVANCE In the absence of a recent concussion, symptom reporting is related to sex and preexisting conditions. Consideration of sex and preexisting health conditions can help prevent misinterpretation of symptoms in student athletes who sustain a concussion.

Published online October 12, 2015.
The Database

• 32,855 student athletes from the state of Maine

• Age: 13-18

• No athlete reported sustaining a concussion in the past 6 months.
ICD-10 Criteria for Postconcussional Syndrome

• Must endorse symptoms in at least 3 domains
  – Physical
  – Emotional
  – Cognitive
  – Insomnia

  – Other domains not considered: Excessive worry over symptoms and intolerance for alcohol.
• Physical Symptoms (headache, dizziness, balance problem, noise sensitive, light sensitive, and/or fatigue)

• Emotional Symptoms (irritability, sadness, nervousness, and/or feeling more emotional),

• Cognitive Symptoms (poor concentration, poor memory, and/or feeling mentally foggy); and

• Insomnia (trouble falling asleep and/or sleeping less than usual).
Remember: To diagnose PCS, the athlete must report symptoms in 3 out of 4 domains

Physical, Emotional, Cognitive, and/or Insomnia
What percentage of boys and girls meet ICD-10 Criteria for a Mild Post-Concussional Syndrome During Baseline Preseason Testing?

- Boys = 19.7%
- Girls = 28.2%
What percentage of boys and girls meet ICD-10 Criteria for a Moderate-Severe Post-Concussional Syndrome During Baseline Preseason Testing?

• Boys = 4.4%

• Girls = 7.2%
Percentages of Uninjured Athletes Meeting ICD-10 Criteria for a Mild Postconcussional Syndrome

<table>
<thead>
<tr>
<th>Category</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample</td>
<td>19.7</td>
<td>28.2</td>
</tr>
<tr>
<td>Academic Problem</td>
<td>28.6</td>
<td>41.2</td>
</tr>
<tr>
<td>ADHD</td>
<td>32.8</td>
<td>50.9</td>
</tr>
<tr>
<td>Migraines</td>
<td>32.9</td>
<td>42.6</td>
</tr>
<tr>
<td>Mental Health Tx</td>
<td>47.3</td>
<td>52.9</td>
</tr>
<tr>
<td>Substance Abuse Tx</td>
<td>47.1</td>
<td>72.2</td>
</tr>
</tbody>
</table>
Percentages of Athletes Meeting ICD-10 Criteria for a Mild Postconcussional Syndrome

<table>
<thead>
<tr>
<th>Category</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Prior Concussions</td>
<td>19.7%</td>
<td>28.2%</td>
</tr>
<tr>
<td>1 Prior Concussion</td>
<td>19.1%</td>
<td>27.3%</td>
</tr>
<tr>
<td>2 Prior Concussions</td>
<td>21.1%</td>
<td>33.3%</td>
</tr>
<tr>
<td>3 Prior Concussions</td>
<td>27.1%</td>
<td>42.1%</td>
</tr>
<tr>
<td>4 Prior Concussions</td>
<td>29.3%</td>
<td>41.8%</td>
</tr>
</tbody>
</table>

Boys vs. Girls comparison
### Percentages of Athletes Meeting ICD-10 Criteria for a Mild Postconcussional Syndrome

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Sample</th>
<th>3 Prior Concussions</th>
<th>Less than 6 Hours Sleep</th>
<th>ADHD + Less than 6 Hours Sleep</th>
<th>Psych Hx + Less than 6 Hours Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>19.7%</td>
<td>29.3%</td>
<td>38.9%</td>
<td>57.3%</td>
<td>60.8%</td>
</tr>
<tr>
<td>Girls</td>
<td>28.2%</td>
<td>41.8%</td>
<td>53.8%</td>
<td>84.4%</td>
<td>77.3%</td>
</tr>
</tbody>
</table>

Sleep insufficiency almost doubles the rate.
Misdiagnosis of the persistent postconcussion syndrome in patients with depression

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Accepted 14 December 2005
Misdiagnosis of PCS in Depression

• 64 patients with depression

• Diagnosed and referred by family physician or psychiatrist

• Independently confirmed diagnosis with SCID-I

Iverson (2006)
PCS-Like Symptoms in Patients with Depression (Blue = Mild; Red = Mod-Severe)
ICD 10 Diagnostic Criteria

Mild PCS = 89.1%

Moderate – Severe Symptom Endorsement

57.8%
Treatment & Rehabilitation
Guidelines for Diagnosing and Managing Pediatric Concussion

First edition, June 2014

CONCUSSIONS

- Headache
- Confusion
- Blurry Vision
- Sickness

I feel weird!
Basic Principles: Initial Weeks Following Injury
(and sometimes months following injury)

- Focused, Evidence-Based Treatment for Specific Symptoms and Problems
  - Medications (headaches, sleep, mental health)
  - Physical Therapy
  - Vestibular Rehabilitation
  - Exercise
  - Psychological Treatment
Exercise as Treatment

• Exercise facilitates molecular markers of neuroplasticity and promotes neurogenesis in the healthy rodent brain and the injured brain.

• Associated with changes in neurotransmitter systems (Chaouloff, 1989; Molteni, Ying, & Gomez-Pinilla, 2002).
Exercise

• Improved mood and lower stress (Callaghan, 2004; Conn, 2010)

• Improved sleep quality (Youngstedt, 2005)

• Positive effects on self-esteem (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004)
Exercise

• Effective treatment, or adjunctive treatment, for mild forms of anxiety and depression (Daley, 2008; Mead et al., 2009; Rethorst, Wipfli, & Landers, 2009)

• Associated with reduced pain and disability in patients with chronic low back pain (Bell & Burnett, 2009; Henchoz & Kai-Lik So, 2008)

• Regular long-term aerobic exercise reduces migraine frequency, severity, and duration (Koseoglu, Akboyraz, Soyuer, & Ersoy, 2003; Lockett & Campbell, 1992)
Research on Exercise for MTBI

• Several small studies suggest exercise training is helpful for persistent symptoms in adolescents and adults
Psychological Treatment for People with Chronic Problems
Post-Concussion Symptoms

- Expectations
  - Secondary Gain
  - Nocebo Effect
- Avoidance
- Attributions & Good Old Days Bias
- Cogniphobia
- Cognitive Hypochondriasis

Primary:
- Depression
- Anxiety
- Life Stress
- Insomnia

Secondary:
- Social
- Psychological Factors
Psychological Treatment

• Cognitive Behavior Therapy

• Self-Management

• Behavioral Activation

• Stress Management

• Acceptance & Commitment Therapy
Conclusions
There is an enormous number of direct and indirect studies supporting a biopsychosocial conceptualization of persistent symptoms following mild TBI.
Many clinical conditions are associated with symptoms.

Personality characteristics and social-environmental factors can be important.

Pre-injury health and mental health is important.

A biopsychosocial model is most appropriate.
Several Neurobiological Factors Might Contribute

• Neurobiological Vulnerability
  – Genetics
  – Neurodevelopmental Disorders (e.g., ADHD)
  – Pre-Existing Psychiatric, Substance Abuse, or Neurological Conditions or Disorders

• Macrostructural Brain Injury

• Microstructural Injury

• Functional and Neurometabolic Cellular Changes
Neurobiology is Important

Considering the “Whole Person” is More Important
Careful and Comprehensive Assessment = Targets for Treatment and Rehabilitation
Reduce Symptoms; Improve Function

• Sleep Disturbance

• Stress & Anxiety

• Depression

• Deconditioning

• Headaches

• Bodily Pain
Treat what you can treat.

Success begets success.

Reduce symptoms.

Improve functioning.
Thank You