Traumatic Brain Injury: Post Concussive Syndrome

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Goals

• What is Post-Concussive Syndrome?
• Pathophysiology, Anatomy, and Risk Factors
• Work-up
• Management
Post-Concussive Syndrome

- Persistent symptoms due to a mTBI after weeks? 1 month? 3 Months?
- There is a lack of consensus regarding the definition of PCS among physician members of the ACSM. A standard definition would improve consistency in concussion research and in clinical practice. (Rose 2015)
- The relevance of symptoms proposed to constitute PCS should be reviewed. A more specific definition of PCS would make diagnosis easier and facilitate prevention as well as treatment of patients with mTBI. (Laborey 2014)
Incidence of PCS

- 10-15% (Alexander 1995, Rutherford 1979)
- Highly Debated
- Myth and the Legend of the Miserable Minority
Pathophysiology

- Persistent alterations in:
  - cell membrane permeability
  - ion transport regulation, neurotransmitter release,
  - cellular metabolism
  - cerebral blood flow
Pathophysiology

- Exacerbation of symptoms during cognitive activity and/or physical exercise, reflective of a persistent cerebral metabolic energy deficiency (Ellis 2015, Maugans 2012)
- Autonomic nervous system dysfunction via impact on cerebrovascular activity (King 1997, Hanna-Pladdy 2001)
Subtypes (Ellis 2015)

1. Vestibulo-ocular PCD -> balance/vision
2. Cervicogenic PCD -> neck strain, headache
3. Physiologic -> fatigue, sleep disturbance, cognitive/attention, mood
Anatomy
Visual System: Afferent and Efferent

Balance Systems

The Vestibulocochlear Nerves - VIII

Vestibulocochlear nerve (VIII)

Vestibular ganglia
Vestibular nerve
Internal acoustic meatus
Cochlear nerve

Cerebellum
Unfolded

Spinocerebellum: Control of muscle tone and coordination
Cerebrocerebellum: Motor planning, learning and memory

Vestibulocerebellum: Balance, postural adjustments, coordination of eye movements

Arousal

Frontal Lobe


Assessment (Ellis 2015)

Figure 1. Proposed algorithm for diagnosis of PCD sub-types. PCD, post-concussion disorder.
Risk Factors

• predicted by concussion history, premorbid mood disorders, other psychiatric illness, or significant life stressors, delayed symptom onset (Moran, Sills, Solomon 2015)

• Other factors: family history of mood disorders, other psychiatric illness, and migraine (Moran, Sills, Solomon 2015)

• litigation
Not Risk Factors

• race, insurance status, body mass index, sport, helmet use, medication use, and type of symptom endorsement

• Structural MRI abnormalities and microstructural white matter findings were not significantly associated with greater post-concussion symptom reporting (Wailjas 2015)
Contradictions

• post-traumatic headache and seizure, CT and laboratory findings (6-hour S100B) were valuable factors for identification of the individual MTBI patient at risk for developing PCS 1 month after the injury (Heidari 2015)

• In soldiers, Blast mechanism of concussion was inconsistently associated with PCS, depending on the definition of concussion utilized.

• A self-reported history of blast mechanism was not associated with persistent PCS for the majority of US soldiers with concussions (Wilk 2010)
Management

• Labwork:
  – B12/Folate, Vitamin D
  – Hormone screen: GH, IGF-1, corticotropin serum cortisol, prolactin, ADH, testosterone/estradiol

• No clear consensus of when to do further imaging
Diffusion tensor tractography

(D’souza 2015)
Functional Neuroimaging

(Sours 2015)
Management

• Avoid further TBI
• Avoid further TBI
• Avoid further TBI
• Graded return to activity
Non-pharmacological Management

- cognitive rest and controlled physical exercise (Leddy 2010, Leddy 2014)
- vestibular rehab (Alsalaheen 2010)
- vision therapy
- neck strengthening, cervical PT (Ellis 2015)
- Cognitive Behavioral Therapy [earlier than later] (Silverberg 2013)
- Others
  - Complementary Medicine
  - Nutraceuticals (Petraglia 2011)
Pharmacological

• Anti-depressants:
  – TCAs: amitriptyline, nortriptyline

• Neurostimulants (Moran 2015, Reddy 2013):
  – methylphenidate, carbidopa/levodopa, amantadine

• Memory: donepezil, memantine, rivastigmine

• Mood stabilizer: Valproic Acid, dextromethorphan (Nguyen 2016), carbamazepine, lamotrogine (Kile 2007)

• Avoid: antipsychotics (typical > atypical), benzodiazepines. Anti-histamines
Conclusions

• We don’t know what it is, how often it happens, but it does
• RF: Previous TBI, previous Neuro/psych dx, litigation
• There are different flavors of PCS
• Unclear but limited role of imaging
• Non-pharmacological > pharmacological management
• Avoid further TBIs and implement a graded return
Citations


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- Petraglia AL, Winkler EA, Bailes JE. Stuck at the bench: potential natural neuroprotective compounds for concussion. Surg Neurol Int 2011; 2: 146


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