DIDACTIC SESSION:
POST-CONCUSSION SYNDROME

POST-CONCUSSION SYNDROME IDENTIFICATION AND MANAGEMENT APPROACH PROGRAM SYLLABUS
2015 AAN Sports Concussion Conference
July 24-26, 2015

Didactic Session: Concussion
Saturday, July 25, 2015
8:00 a.m. – 11:30 a.m.

Program Directors
Jeffrey S. Kutcher, MD, FAAN – Ann Arbor, MI
Christopher Giza, MD – Los Angeles, CA

Program Schedule and Faculty
8:00 AM – 8:15 AM Welcome and Day Overview
8:15 AM – 8:55 AM Post-Concussion Syndrome Identification and Management Approach
  Nicole D. Reams, MD
  Ann Arbor, MI
8:55 AM – 9:35 AM Managing PCS in a Neuro Sports Clinic
  Gillian A. Hotz, PhD
  Miami, FL
9:35 AM – 9:50 AM Break
9:50 AM - 10:30 AM Vestibular Therapy Approaches to PCS
  Kathryn Schneider, PhD
  Calgary, AB, Canada
10:30 AM – 11:10 AM Post-Concussion Educational Intervention and Return to School
  Karen McAvoy, Psy.D
  Denver, CO
11:10 AM – 11:30 AM Panel Q&A

Program Description:
This three-day conference will focus on the science behind concussion. The conference will follow a new programming model to include five half-day sessions, each with its own general theme, faculty presentations, and a panel discussion. Poster presentations will occur on the first two days of the conference. The five half-day topics are: concussion, concussion research (epidemiology, biomechanics, and imaging), post-concussive syndrome, research (mTBI), and chronic Sequelae. In addition, there will be lunchtime breakout sessions targeted to the following audiences: professional sports, collegiate sports, high school sports, and youth sports.

Learning Objectives:
Participants should be able to accurately and appropriately diagnose concussion; institute appropriate and clinically useful diagnostic tests when indicated; provide state-of-the-art management of concussed athletes and individuals; make safe and appropriate return to play, school, work, and life decisions; and educate athletes, non-health care professionals, and other health care practitioners on key issues related to concussion.

Recommended Audience:
Neurologists, Athletic Trainers, Primary Care Physicians, Neuropsychologists, and Sports Medicine Professionals.

Accreditation
The American Academy of Neurology is accredited by the Accreditation Council for Continuing Medical Education
(ACCME) to provide continuing medical education for physicians.

AMA PRA Credit
The AAN designates these educational activities for a maximum number of hours in category 1 credit toward the AMA Physician’s Recognition Award. The number of credits assigned to each individual program is outlined in the program’s description. Each physician should only claim those hours of credit that he/she actually spent in the activity.

Certificates for Non-Physicians
Non-physician participating in the programs will receive a certificate of attendance indicating attendance at an activity designated for AMA PRA category 1 credit.

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- Jeffrey S. Kutcher, MD – Dr. Kutcher has received personal compensation for activities with the National Basketball Association Concussion Program as a director, with National Hockey League Players Association and ElMindA, Ltd. As a consultant. Dr. Kutcher has received research support from ElMindA, Ltd. For a research grant.
- Christopher Giza, MD – Dr. Giza has received personal compensation for activities with the Medical Education Speakers Bureau and for medicolegal consultation with Alcobra and Pearson TLC.
- Nicole D. Reams, MD – Dr. Reams has nothing to disclose.
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- Karen McAvoy, Psy.D – Dr. McAvoy has nothing to disclose.

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POST-CONCUSSION SYNDROME IDENTIFICATION AND MANAGEMENT APPROACH

Nicole D. Reams, MD
Northshore University Health System
Ann Arbor, MI

Definition: Postconcussion syndrome (PCS) generally refers to a large number of neurologic, behavioral, cognitive, and psychiatric symptoms and signs that occur following concussion and persist beyond 3 months. These symptoms cause impairment in social or occupational functioning and are considered a significant decline or alteration from previous level of functioning. ICD-10 definition includes that there are organic and psychogenic features of this disorder. PCS should be delineated from prolonged symptoms of acute concussion. It is important to delineate PCS from prolonged symptoms of acute concussion because athletes who remain injured will not be encouraged in the same way to push cognitive or physical exertion due to concern that this would worsen or exacerbate underlying injury.

- What can prolong symptoms of acute concussion?
  - Underrest
  - Overrest
  - Personal or family history of migraine, ADHD, mood disorder, other psychiatric disorder
  - Medication overuse
  - Untreated vestibular or cervicogenic disturbance
  - Re-injury (second hit prior to full recovery from initial insult)

- Clues to look for that it is PCS and not acute concussion:
  - Timing (> 3 months is no longer acute concussion)
  - Pattern of symptoms: if symptoms are fluctuating, intermittent, unpredictable, and not following an overall trajectory of improvement, this would make you lean towards PCS as a diagnosis

How to manage a PCS patient
  - Investigate for the root of the symptoms and focus on treatment (ie. is anxiety driving symptoms? are chronic migraines the reason for poor school return and sleep disturbance?)
  - Consider NSAID or prednisone burst to break a headache cycle
  - Consider sleep aids (melatonin), migraine prophylactics (TCAs, AEDs), antidepressants or anxiolytics (SSRIs) for short- to moderate-term management
  - Consider referrals for manual physical therapy, vestibular therapy, psychology
  - Initiate physical exertion to symptom threshold with gradual gains in duration and intensity

References:


Postconcussion Syndrome

Nicole Reams, MD
Northshore University Health System, Chicago, IL

Disclosures

- I have no relevant financial disclosures.

Objectives

- Understand clinical presentation of PCS
- Identify risk factors for prolonged symptoms
- Understand the underlying psychology and physiology of the syndrome
- Be able to implement a treatment plan for a patient similar to presented
“Post concussion syndrome is an ill-defined, ambiguous, poorly understood, syndromic cocktail of myriad symptoms and/or cognitive deficits lasting anywhere from a few weeks to a few years...maybe”

- Jeffrey S. Kutcher
- Director of Michigan NeuroSport

Case
- 18-year-old female collegiate lacrosse player

- About halfway through the 3rd quarter in a lacrosse game on February 26th, she bent down to scoop up the ball and ran head first into an opponent’s shoulder, falling to the ground backwards with a subsequent impact of the occiput to the ground
Case

• No LOC, no PTA

• Immediately felt dizzy, imbalanced, and disoriented, and noted bilateral blurry vision

Case

• Do you think she's concussed?
  • Definite?
  • Probable?
  • Possible?
  • Unlikely?

• Would you remove her from the game?
  • Kutcher & Giza Continuum 2014

Case

• The impact was witnessed by her AT, but she denied symptoms and was released back to play, finishing the remainder of the 3rd and the 4th quarters.

• There were no further impacts
Case

• On the bus ride home to her home school, she had onset of holocranial throbbing headache, nausea, photophobia, and phonophobia

• She could not eat the post-game meal due to nausea and loss of appetite

• That night she had difficulty falling asleep and recalls awakening at least three times that night

Case

• The following day, she had persistent symptoms and reported these to the AT.

• Assessment by AT and team physician resulted in a diagnosis of "concussion" and she was removed from physical participation with the team

Case

• Over the following 10 days, she noted slow but steady improvements in headaches, cognition, balance, sleep, and dizziness

• The athlete removed herself from all classes, missed mid-term exams

• She reported that during this first couple of weeks, she mostly slept, including long daytime naps and little to no cognitive or physical activity
Case
• At week 3, she attempted to go back to classes, but found she could only tolerate 25-30 minutes in one class before her symptoms exacerbated, so she would return to her room and sleep

• She continued this pattern for about 2 weeks, before withdrawing academically for the semester

Case
• She did not return to lacrosse and has not attempted workouts on her own

Case
• She presents to your office in July (4+ months post-injury)

• She complains of frequent headaches, dizziness (lightheadedness), trouble concentrating (“foggy head”), and neck pain

• She is taking Motrin 400-600mg multiple times per day without much improvement. She has not had other treatment interventions.
Case

- She wishes to return to classes
- She wants to return to lacrosse

Case

- PMHx:
  - 1. Migraines (about 1 per year, aborted with Motrin)
  - 2. No history of concussion

- FHx: Father and twin sister with migraine headaches
- SHx: 4.0 student, studying mechanical engineering
- Medications:
  - 1. Motrin PRN

Case

- Exam
  - Neck: reduced range of motion in all directions with particular discomfort with neck extension; tenderness with palpation of high cervical paraspinals; tenderness at bilateral occipital notches with reproduction of throbbing head pain
  - PERRL, EOMI w/o nystagmus, convergence <5cm, funduscopic exam nl
  - CNS otherwise intact
  - Strength, sensation, and reflex exam intact
  - Complex balance testing intact
Is she still concussed?

Poor association between smx and biochemical change

How do you know a concussion is resolved?

- Well, you don’t
- Timing (how far out is the athlete from the injury)
- Gray area (what if the athlete presents to you right at the 2 week mark)
- Response to gradual exertion
Examine for factors that could prolong acute injury

- Amount of rest: underrest vs. overrest

Physical activity and cognitive recovery

0: no school or physical
1: school only
2: school + light activity (jogging, mowing)
3: school activity and sports practice
4: school activity and participation in sports game

A word about the PCSS

Has been validated against fMRI changes in the bilateral prefrontal cortex and with computerized cognitive testing.
Cognitive rest and recovery

Strict Rest vs. Gradual Return

Exercise can be beneficial

- Exercise 0-6 days post-injury exacerbated cognitive impairments
- Exercise during the post-acute phase 14-20 days after injury actually improved learning and memory.
- Voluntary exercise leads to an increase in brain-derived neurotrophic factor (BDNF), which plays a key role in hippocampal neuronal plasticity.
Our case

• Think about amount of rest in our patient
  • Immediate return to play after impact
  • Prolonged cognitive and physical total rest

Examine for factors that could prolong acute injury

• Re-injury/second impact
  • Increased risk for subsequent head injury if still recovering from initial concussion

When repeat injury occurs within a period of vulnerability, there are increased metabolic changes, and cumulative cognitive effects which can be persistent.

Examine for factors that could prolong acute injury

• Genetic make-up
  • Personal or family history of
    • Migraine
    • Mood disorder
    • Other psychiatric illness
    • ADHD
  • Concept of lowering threshold
Examine for factors that could prolong acute injury

- Neck
- Vestibular
- Medication use/overuse

Pertinent features of our pt’s history

- Mechanism of injury
- Continued play day of injury
- Probable overrest
- Personal and family history of migraine
- Medication overuse

What is PCS?
PCS

• What distinguishes PCS from post-concussion symptoms?
  • Duration of symptoms

  • The duration of symptoms necessary before consideration/diagnosis of PCS is debated
    • Physicians vary in their PCS definition: <2 weeks (26.6%), 2 weeks to 1 month (20.4%), 1–3 months (33%) and >3 months (11.1%)
    • Generally 1-6 weeks is accepted as threshold

Alexander Neurology 1995

PCS

• Up to 15% of concussions have been associated with persistent symptoms

Alexander Neurology 1995

Features

• Acute
• Persistent
• Somatoform

Cognitive	Physical	Behavioral

Slowed response speed	Headache	Depression
Mental fatigue	Nausea	Anxiety
Poor concentration	Vision changes	Panic attacks
Dizziness	Light sensitivity	Insomnia
Trouble learning	Tinnitus	Personality changes

Memory difficulty	Noise sensitivity	Increased emotionallty
Disorganization	Dizziness	Clumsiness

Problem-solving difficulty	Vertigo	Apathy
Balance problems	LWtered attention tolerance
Fatigue	Increased sensitivity to alcohol
Sleep disturbance
Can we predict who will develop PCS?

- Risk Factors
  - Female gender
  - Migraine symptoms, previous migraine
  - Self-reported cognitive decline
  - Phonophobia or Photophobia
  - High symptom burden at initial visit (mean 12 days)
  - Premorbid psychiatric illness?
  - Amnesia?

Can we predict who will develop PCS?

- There is no evidence for:
  - Presence of LOC
  - History of concussion
  - Headache, fatigue, dizziness
  - Age

Back to the case...
Well, if she’s not still concussed, why is she still exhibiting so many symptoms?

- "Psychogenesis" vs "Physiogenesis"

Psychogenesis

- Fear of re-injury
- Fear of being perceived as "weak"
- Fear of losing their role
- Fear of financial loss
- Social isolation
- Loss of identity

Psychogenesis

- Perceived expectations following injury
  - Tendency to attribute common current symptoms and health concerns to a past concussion has been called 'expectation as aetiology'
  - "Good old days" bias
  - Poor coping mechanisms/coping style
  - Motivational and financial factors
**Psychogenesis**

- Pre-morbid psychiatric history, life stressors and pain were predictive of post-concussion symptoms at follow-up.
- Anxiety sensitivity

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**Physiogenesis**

- Impairment in global brain metabolism
- Persistent alterations in cell membrane permeability, ion transport regulation, neurotransmitter release, cellular metabolism and cerebral bloodflow
- Neuro- and Systemic Inflammation: “Post-Inflammatory Brain Syndrome”

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**Physiogenesis: role of inflammation**

- Immediate response: serum levels of cytokines are increased with correlations to injury severity; neutrophils and T cells infiltrate the brain (peak at 1 day)
- Persistent response: some responses are upregulated several days after with some lasting for up to 6 months
  - Microglial phenotypes are altered: active hypertrophic

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Physiogenesis: inflammation → symptoms?

Further evidence for physiogenesis

- qEEG and SPECT showed focal cortical dysfunction, persistent BBB disruption and reduced global and regional perfusion
- Abnormal CBF velocity by Doppler and regulation that may be the result of altered sensitivity to CO2
- Diffusion tensor imaging revealed spatially varying and heterogeneous localized irregularities in patients with PCS that persisted even as patient symptoms decreased
How do you manage this patient?
- Look for the crux of the symptoms
- Rule out extraneous factors: litigation, does the player want to return to their sport

Role for Neuropsych testing
- Rule out alternative explanations
- Establish objective evidence of normality
- Counseling regarding retirement
- Some individuals can demonstrate deficits in memory and learning, others will show only attentional deficits, and some normal

Role for imaging
- MRI or CT is generally used to rule out alternative explanations
- fMRI can show reductions in regional brain activation
- PET: regional hypometabolism during spatial memory tasks?
- SPECT: basal ganglia hypoperfusion and frontal hypoperfusion correlate with headaches and deficits in executive function
- DTI: no clear change for PCS vs. non-PCS individuals
Treatment

- Depends on the “crux” of the symptoms
- Consider:
  - Vestibular therapy
  - Manual PT for the neck
  - Naproxen or prednisone burst and taper
  - Migraine prophylactic agent: TCA, Topamax
  - Sleep aid: melatonin
  - Referral to psychiatry or psychology; CBT
  - Pharmacotherapy for Depression or anxiety

Essential

- Gradual reintroduction of physical activity: to symptom threshold
  - Physical or cognitive exertion can temporarily increase post-concussion symptoms at any point in recovery, but there is no evidence that there are any long-term consequences from brief increases in symptoms.
  - Supervision can decrease anxiety
- Physical exercise is a normal state for their brain and body
- Athletic pursuit is part of their identity

Essential

- Give them a framework and expectation for improvement
- "Permission to get better"
Evidence-based treatments

- Methylphenidate: low dose (5 mg x 3) and normal dose (20 mg x 3) for 4 weeks improved mental fatigue, dose-dependent
- Caloric-restricted diet (reduced calories) hinders behavioral outcomes and may be protective
- Psychoeducational intervention within acute period reduces symptoms
- CBT in acute period in those deemed at risk for PCS
- Controlled aerobic exercise rehabilitation may help restore normal cerebral blood flow regulation

- Enzogenol, a flavonoid with anti-inflammatory properties, has improved cognitive function in adults when administered for at least 8 weeks between 3 and 12 months after mTBI (Theadom et al., 2013)

- Ongoing: sublingual melatonin 3mg and 10mg x 28 days

What we still don’t know

- How long is too long for acute concussion recovery?
- What is the role of psychologic factors in concussion recovery/PCS?
- What are best treatment interventions to prevent prolonged smx?

Thank you!

- Questions?
References


