Acute Management of Concussion

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Learning Objectives
• Demonstrate an understanding of the full continuum of care required for individuals with acute concussion.
• Have a basic understanding of the physiology of concussion and the approach for return-to-competition after sport-related head injury.
• Identify potential activity restrictions as well as possible school and work modifications in the acute to subacute time period after concussion.
• Understand the potential ramifications of repetitive subconcussive head trauma.
Why a **HEADACHE SPECIALIST** in **SPORTS NEUROLOGY**?

Prevalence of PTH in Sport-Related Concussion


![Pie chart showing 6% PTH and 94% non-PTH](chart.png)
Are athletes different?

Are athletes different?
In how they are managed?

Are athletes different?
In how they are managed?
In how they respond?
Comprehensive Assessment of Headache: Experience in Collegiate Student-Athletes

A Report by the NCAA Headache Task Force

• Subjects (N=834) from 5 Division-I member institutions
• 597 males and 237 females
• Noncontact/Contact sports

Contact Exposure

Track & Field  Tennis  Swimming  Basketball  Volleyball  Soccer  Football
### Comprehensive Assessment of Headache: Experience in Collegiate Student-Athletes cont.

*An A Report by the NCAA Headache Task Force*

<table>
<thead>
<tr>
<th>Parameter</th>
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Consider combat sports…..

- Professional MMA (New Jersey):
  - KO = 30 day suspension, obtain CT head scan, neurological evaluation (New Jersey)
- Professional MMA (North Carolina):
  - TKO = 30 day suspension
  - KO = 60 day suspension
- At the discretion of athletic commissions, shorter (or) longer suspension periods may be issued
What is “RECOVERY”?  

Typical Recovery from Simple Concussion  
80-90% of athletes will recover within 7-10 days of injury

Typical Recovery from Simple Concussion

80-90% of athletes will recover within 7-10 days of injury.

What about neurophysiological recovery?


Hot off the press…..

Multiparametric MRI changes persist beyond recovery in concussed adolescent hockey players

Abstract

Multiparametric MRI changes persist beyond recovery in concussed adolescent hockey players (11–14 years old). Clinical measures, diffusion metrics, magnetization transfer and perfusion metrics are significantly increased in concussed hockey players compared to non-injured controls within 24–72 hours after injury. Functional magnetic resonance imaging (fMRI) studies performed 24–72 hours after injury revealed decreased functional connectivity in bilateral inferior frontal cortex, bilateral precuneus, right ventral anterior cingulate cortex, right superior frontal gyrus, and left thalamus. There was also significantly increased activation in the right thalamus, left cerebellum and left thalamus. Functional connectivity differences were observed between groups in the left middle frontal gyrus, left inferior frontal gyrus, and left postcentral gyrus. These findings demonstrate persistent neurophysiological changes in adolescents 24–72 hours after injury and these changes are associated with clinical symptoms of concussion.

Longitudinal fMRI study in concussed subjects

- Persistent, significantly increased activation
  - Dorsolateral Prefrontal Cortex
  - Inferior Parietal Lobe
- No significant differences on standard memory tasks vs. controls

Functional brain activation differences persist at 2 months after injury in concussed athletes

Timetable of Return-to-Fight

- No two concussions are alike:
  - Symptoms (physical, cognitive, emotional) & recovery

1. Why administer blanket generalizations with regard to return-to-fight timelines?
2. Should we limit the number of bouts/rounds per year?

Current State of Affairs

- All major professional sports leagues in the United States have a formal concussion policy in place:
Neurological Care in Combat Sports

- There is little uniformity regarding medical regulation of professional boxing in the United States.
- Boxing & Mixed Martial Arts remain the only major professional sports in America that do not have a national and/or unified commission.
- Traditional guidelines used for return to sport participation after concussion are inconsistently applied, dependent upon specific jurisdiction.

Since the 103rd Congress in 1993, there have been no fewer than 19 attempts at establishing a national commission for professional boxing through legislation

- What about headaches in combat sports?
• Despite numerous studies exploring the epidemiology of headache in the layperson, very little is known about the prevalence and nature of headaches in combat sports participants.

• Such scenarios are concerning in this genre of sport where head trauma is routinely encountered.

• It is often unclear whether an athlete is experiencing:
  1. Exacerbation of a primary headache disorder
  2. New onset headache unrelated to trauma
  3. Chronic secondary headache related to prior head injury
  4. Recently sustained an acute concussive injury
Comprehensive Headache Experience in Combat Sport Athletes: Preliminary Data from the Professional Fighters Brain Health Study

Seifert T, Bernick; Data Collection Ongoing

- Of those with a self-reported hx of zero concussions (n=55)
  - 34 (61.8%) had no hx of headache
  - 14 (25.5%) had hx of mild headache
  - 7 (12.7%) had hx of moderate/severe headache

- Of those with a self-reported hx of 5 or more concussions (n=16)
  - 2 (12.5%) had no hx of headache
  - 2 (12.5%) had hx of mild headache
  - 12 (75.1%) had hx of moderate/severe headache

Conclusions (to date)

- Headache is common in combat sports and is seemingly associated with a history of recurrent head injury.

- In a sport where chronic neurological impairment remains the most difficult safety challenge………

.....could headache potentially serve as a clinical marker for those combat sport athletes at higher risk for chronic neurologic sequelae?
“It is imperative that ringside physicians obtain a thorough headache history of all athletes participating in combat sports, so that enhanced monitoring techniques are undertaken.”

Case #2

From 1977......

Migraine as a sequela of blunt head injury

Simon Behman
Consultant Emeritus in Neurology, Guy’s Hospital, and Consultant Physician, Moorfields Eye Hospital

Chronic Headache After Head Trauma

Trauma to the head (or neck) may trigger the migraine process in an individual who did not previously experience migraine headaches.


Chronic Headache After Head Trauma

- Approximately 15% develop chronic post-traumatic headache following concussion

- Of those with post-concussive symptoms at one year, 100% have post-traumatic headache

Chronicity of Post-Traumatic Headache (in children)

  - 43% of children w/mTBI had HA 3 months post-injury
Is Preexisting Migraine a Risk Factor for Prolonged Recovery after Concussion?

- Head (or neck) injuries can increase the severity of headaches in preexisting migraine
  – Packard RC. J Head Trauma Rehabil. 1999
- “It is the experience of the authors that people who have migraines seem to have more severe and prolonged concussion courses after injury.”

Is Migraine a Risk Factor for Concussion?

- Personal or Family History of migraine has been observed in >80% of symptomatic mTBI

Is Migraine a Risk Factor for Concussion?

- Migraine is associated with dysfunctional pain modulation capabilities
- Post-traumatic headache has similar degrees of pain adaptation as migraine on measures of pain modulation
- Is the enhanced response in migraineurs following head trauma due to an inherent dysfunction in pain processing?
“Controlling for between-group differences in age and sex, there was a significant positive association between concussion and history of migraine headache.”

“It is far more important to know what person has the disease than what disease the person has.”

--- Hippocrates, 450 BC
Risk Factors for prolonged post-concussive symptoms


- Personal hx mood disorders
- Family hx mood disorders
- Personal hx migraine
- Family hx migraine
- Hx prior concussion
- Delayed symptom onset
- ALL associated with >3 mo duration of sx

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Migraine with Aura is the Major Phenotype of Post-Traumatic Headache: A Case Control Study

James S. Green, MD, PhD; Kerith Arnerich, MD; Shalini Mathew, MD

From poster abstract presented at 2017 AAN Annual Meeting. Boston, MA

- For those with Mild TBI injuries with resultant PTH, 71.8% presented as migrainous phenotype with aura
Posttraumatic Headache with Migraine Characteristics

Posttraumatic migraine characteristics are related to prolonged symptom recovery.\(^1,2\)

Athletes with posttraumatic migraine characteristics experience greater deficits on neurocognitive testing.\(^3\)

Should we be treating more aggressively in the acute time period post-injury?

Treatment of Headache After mTBI

“Assertive, early treatment [of headache after mTBI] may be warranted to avoid chronicity and disability.”


Research Submission

Pathophysiology of Chronic Migraine and Mode of Action of Preventive Medications

Nancy T. Mathew, MD, FRCP(C)

• “Timely, early intervention with appropriate prophylactic therapy may succeed in reversing the pathophysiologic, and perhaps even the structural, changes that occur in the brains of migraine sufferers.”

• What are our options in pharmacological treatment?
Concussion in Sport: Treatment

- What is the evidence for and efficacy of specific treatment interventions? (e.g. rehabilitation and pharmacological therapy)
- 7653 publications screened
- 3 fit criterion for pharmacological treatment
  - Only 2 (of 3) fulfilled criterion for pharmacological treatment of post-traumatic headache

Treatment – Medical

- Headache improved with Amitriptyline (n=400 consecutive patients) Bramley et al 2015
- Headache severity decreased in 93% of individuals with peripheral nerve block (n=28 consecutive patients; mean age 14.6 years) Dubrovsky et al, 2014
- Limited evidence to support medical management of SRC, including the treatment of POST-TRAUMATIC HEADACHE.
What’s new in PTH Treatment?

- Botulinum toxin

- Occipital nerve blocks

- Sphenopalatine ganglion block

- Transcranial magnetic stimulation

- Treatment outcomes with Triptans compared to NSAIDs/analgesics or opioid medications in post-concussive patients from the North Texas Concussion Registry (ConTex)
  - Abstract presented at 2017 AHS Scientific Meeting, Boston, MA
  - Individuals treated with triptans were more likely to report severe headache 3 months after initial evaluation compared to those treated with NSAIDs or opioids

ConTex UT Southwestern Medical Center
What’s coming in PTH Treatment?

- Concussion leads to the development of headache that is mediated through a CGRP-dependent mechanism
- Treatment with anti-CGRP antibodies may be a useful approach to treat PTH

Back to the diver....
Persistent Posttraumatic Headache—A Myth?

John S. Nielsen, MD

Persistent posttraumatic headache (PPH) can be a source of distress for patients and their families. PPH is defined as headache occurring more than 1 year after a traumatic event, such as a head injury or surgery. The onset of PPH can be acute or delayed, and it may be either unilateral or bilateral. The headache can range in severity from mild to severe and may be associated with other symptoms such as nausea, vomiting, and sensitivity to light or sound.

The management of PPH requires a multidisciplinary approach that includes medical, surgical, and psychological interventions. The goal is to alleviate symptoms and improve the patient's quality of life. The use of non-steroidal anti-inflammatory drugs (NSAIDs) and other pain medications may be effective in relieving pain. In some cases, the use of nerve blocks or ablative procedures may be necessary. Cognitive-behavioral therapy (CBT) and relaxation techniques can also be useful in managing the pain.

Transformed or Evolutive Migraine

Niran T. Mathew, M.D., F.R.C.P., (U.K); Revere, Ph.D. and Francisco Perez, Ph.D.

Reprint requests to: Niran T. Mathew, M.D., Houston Headache Clinic, 1213 Hamman Dr. #100, Houston, Texas 77004.

Accepted for Publication: January 30, 1997
In these patients, migraine loses its typical pattern of recurrent attacks separated by intervals of complete well being: the episodic headache evolves into a chronic daily headache.

Episodic Headache ➔ Chronic Daily Headache

Chronic Daily Headache ➔ Episodic Headache
Summary / Call to Action

• The sports medicine world is looking to headache specialists for guidance
• Desperate need for high quality* evidence-based data in the treatment of PTH
• Consistent use of headache classification is necessary (i.e. ICHD 3-beta version)
• Look for answers in athletes...the world will thank you!
Thank You!
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