Headache after Head Injury
- Clinical Pearls

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Learning Objectives

1. Discuss the historical and current controversies

2. Review PTH diagnostic criteria, characteristics, risk factors, perpetuating factors

3. Highlight the Approach to the Patient With PTH

4. Explore Pearls & Pitfalls in PTH Management
How Common are Head Injuries?

- 150,000 Ontarians diagnosed with concussions annually

- Majority of head injuries are mild
What are the Most Common Causes of Head Injury?
Post-Traumatic Headache: A look back through the centuries
Historical Aspects of Concussion/PTH

- 19th Century
  - Psychoneurosis & Compensation Neurosis
  - Traumatic Neurosis & Railway Spine and Brain

- 21st Century
  - Malingering, Somatic Symptom Disorder
  - Post-Concussion Syndrome
“Although no objective signs accompany these complaints, they are so uniform from case to case that the symptoms cannot be regarded as other than genuine”.

Courtesy of Dr. John Edmeads
“Although the blow is unquestionably the precipitant, the underlying cause is always the patient’s mentally inferior background, largely an hereditary acquisition”.

Courtesy of Dr. John Edmeads
20th Century View

- Miller, 1961
  - “The most consistent clinical feature is the subject’s unshakable conviction of unfitness to work (i.e. compensation neurosis)

- Symonds, 1962
  - It is, I think, questionable whether the affects of concussion, however slight, are ever completely reversible (i.e. traumatic neurosis)

Courtesy of Dr. Randolph Evans
How Do You Diagnose PTH?
ICDH-3 Classification

Headache attributable to head and/or neck trauma
“Headache *Attributed* to Head and/or Neck Trauma”

- 5.1 Acute headache attributed to traumatic injury to the head
- 5.2 Persistent headache attributed to traumatic injury to the head
- 5.3 Acute headache attributed to whiplash injury
- 5.4 Persistent headache attributed to whiplash injury
According to ICHD-3, to meet criteria for PTH, the headache must begin within what time frame from the Head Injury?

A. 24 hours
B. 72 hours
A. 1 week
B. < 30 days
5.2 Persistent Headache Attributed to Mild Head Injury

- **A**- headaches, no typical characteristics known

- **B**- head trauma with all of:
  - Either no loss of consciousness, or if it occurred < 30 min in duration
  - Glasgow Coma Scale 13 or more
  - Symptoms and/or signs diagnostic of concussion

- **C**- headache develops within 7 days of trauma

- **D**- headache continues for > 3 months post trauma
What % of Individuals Develop Persistent Headache After a HI?
How Does a Head Injury Cause PTH?
Mechanism of Concussion - Through the Centuries

- Queyrat 1657 – commotio cerebri
- Littre 1705 – circulatory failure
- Petit 1774 – nerve cell shock
- Baudens 1836 – molecular vibration
- Trotter 1924 – acute compressive anemia

Courtesy of Dr. Randolph Evans
The Pathophysiology of Concussion

Meeryo C. Choe

From blast to bench: a translational mini-review of post-traumatic headache

Laura S Moye and Amynah A Pradhan

Department of Psychiatry, University of Illinois at Chicago
Concussion: Metabolic and Structural Consequences

A: Neuronal Changes

- Increased energy demand and glucose consumption to run the pumps and restore equilibrium
- Worst case scenario: Axonal disruption
- Decreased energy production and reduced brain blood flow/nutrient supply
- Worst case scenario: Apoptosis/cell death

B: Axonal Changes.
Frequent mild head injury promotes trigeminal sensitivity concomitant with microglial proliferation, astrocytosis, and increased neuropeptide levels in the trigeminal pain system

Ashley L. Tyburski, Lan Cheng, Soroush Assari, Kourosh Darvish and Melanie B. Elliott
Persistent post-traumatic headache vs. migraine: an MRI study demonstrating differences in brain structure

Todd J. Schwedt\textsuperscript{1*}, Catherine D. Chong\textsuperscript{1,3}, Jacob Peplinski\textsuperscript{3}, Katherine Ross\textsuperscript{2} and Visar Berisha\textsuperscript{3}
Proposed Mechanisms of PTH

- Injuries to
  - Scalp
  - Skull
  - Dura
  - Specific Nerves of the Head/Neck
  - Discs
  - Facet
  - Bones
  - Ligaments
  - Muscles
  - Sympathetic nerve fibers of the arterial vessels
  - TMJ

- Cortical Spreading Depression
- Release of Excitatory neurotransmitters
- Release of Inhibitory Neurotransmitters
- Increased Intracranial Pressure
- Decreased Intracranial Pressure
- Impaired cerebral vascular autoregulation
- Impairment of the ascending and descending pain modulatory systems
What Factors Maintain and Perpetuate PTH?
Proposed Mechanisms of PTH

- **Initiation**
  - Physical Factors

- **Maintenance or Perpetuation**
  - Physical Factors
  - Medical Factors
  - Situational Factors
  - Psychological Factors
  - Personality Factors
  - Disability/Compensation Factors
Preinjury somatization symptoms contribute to clinical recovery after sport-related concussion

Lindsay D. Nelson, PhD
Sergey Tarima, PhD
Ashley A. LaRoche, BS
Thomas A. Hammeke, PhD
William R. Bass, PhD

ABSTRACT

Objective: To determine the degree to which preinjury and acute postinjury psychosocial and injury-related variables predict symptom duration following sport-related concussion.

Methods: A total of 2,055 high school and collegiate athletes completed preseason evaluations. Concussed athletes (n = 127) repeated assessments serially (<24 hours and days 8, 15, and 45) post-

Conclusions: Preinjury somatization symptoms contribute to reported postconcussive symptom recovery via their influence on acute postconcussive symptoms. The findings highlight the relevance of premorbid psychological factors in postconcussive recovery, even in a healthy athlete sample relatively free of psychopathology or medical comorbidities. Future research should elucidate the neurobiopsychosocial mechanisms that explain the role of this individual difference variable in outcome following concussive injury. Neurology® 2016;86:1856-1863
Early predictors of outcome after mild traumatic brain injury (UPFRONT): an observational cohort study

Joukje van der Naalt, Marieke E Timmerman, Myrthe E de Koning, Harm J van der Horn, Myrthe E Scheenen, Bram Jacobs, Gerard Hageman, Tansel Yilmaz, Gerwin Roks, Jacoba M Spikman

Interpretation Psychological factors (ie, emotional distress and maladaptive coping experienced early after injury) in combination with pre-injury mental health problems, education, and age are important predictors for recovery at 6 months following mTBI. These findings provide targets for early interventions to improve outcome in a subgroup of patients at risk of incomplete recovery from mTBI, and warrant validation.
Predictors of Postconcussive Symptoms 3 Months After Mild Traumatic Brain Injury

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Monash University; Alfred Hospital; and National Trauma Research Institute, Melbourne, Australia

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Monash University; Monash-Epworth Rehabilitation Research Centre, Epworth Hospital; and National Trauma Research Institute, Melbourne, Australia

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Monash University, National Trauma Research Institute and University of South Australia

Michael Schönberger  
Monash University; Monash-Epworth Rehabilitation Research Centre, Epworth Hospital; and University of Freiburg

Objective: There is continuing controversy regarding predictors of poor outcome following mild traumatic brain injury (mTBI). This study aimed to prospectively examine the influence of preinjury factors, injury-related factors, and postinjury factors on outcome following mTBI. Method: Participants were 123 patients with mTBI and 100 trauma patient controls recruited and assessed in the emergency department and followed up 1 week and 3 months postinjury. Outcome was measured in terms of reported postconcussional symptoms. Measures included the ImPACT Post-Concussional Symptom Scale and cognitive concussion battery, including Attention, Verbal and Visual memory, Processing Speed and Reaction Time modules, pre- and postinjury SF-36 and MINI Psychiatric status ratings, VAS Pain Inventory, Hospital Anxiety and Depression Scale, PTSD Checklist–Specific, and Revised Social Readjustment Scale. Results: Presence of mTBI predicted postconcussional symptoms 1 week postinjury, along with being female and premorbid psychiatric history, with elevated HADS anxiety a concurrent indicator. However, at 3 months, preinjury physical or psychiatric problems but not mTBI most strongly predicted continuing symptoms, with concurrent indicators including HADS anxiety, PTSD symptoms, other life stressors and pain. HADS anxiety and age predicted 3-month PCS in the mTBI group, whereas PTSD symptoms and other life stressors were most significant for the controls. Cognitive measures were not predictive of PCS at 1 week or 3 months. Conclusions: Given the evident influence of both premorbid and concurrent psychiatric problems, especially anxiety, on postinjury symptoms, managing the anxiety response in vulnerable individuals with mTBI may be important to minimize ongoing sequelae.
Risk Factors for PTH

- Milder Trauma?
- Age?
- Female Sex?
- Lower SES, Intelligence?
- History of migraine
- Family hx of migraine?
- Previous head injury
- Depression and anxiety
- Somatization
- Catastrophizing
- Maladaptive coping
What Types of Headaches Develop after a Head Injury?
Why Types of Headache Occur in PTH?

- NEW headache
- EXACERBATION of underlying headache
Types of PTH

- Migraine
- Tension-type headache
- Unclassifiable
- Cervicogenic
  - Occipital Neuralgia, Supraorbital Neuralgia, Infraorbital Neuralgia
  - Other (cluster, hemicrania continua)
Tension-Type Headache

- Recurrent similar headache
- Last from 30min – 7 days
- At least 2 of:
  - pressing/tightening
  - mild/mod intensity
  - bilateral
  - no change with exercise
- Both of the following
  - No N/V
  - only 1 of photo/phonophobia
Migraine

- Recurrent headaches
- Last 4-72 hrs untreated
- > 2 of the following
  - unilateral
  - pulsating
  - mod-severe intensity
  - aggravated by (or causes avoidance) of exertion
- > 1 of the following
  - nausea +/- vomiting
  - photo- + phonophobia
- No evidence on history or physical of another cause
Idiopathic Stabbing Headache

- Head pain occurring as a single stab or volley of stab
- Stabs may last for up to a few seconds and recur irregularly
- No accompanying symptoms
Exertional Headache

A. Pulsating headache meeting B and C

B. Lasting from 5 minutes to 48 hours

C. Brought on by and occurring only during or after physical exertion
How Do You Approach PTH?
PTH: A Challenging Situation

- Can’t see it
  - CT, MRI, EEG typically all normal

- Can’t touch it
  - Physical examination typically normal

- Can’t quantify it
  - Purely subjective
How Do You Approach PTH?

- Take a Good History
- Review Medical Brief and Obtain Ancillary Info
- Screen For and Address
  - Insomnia, Depression, Anxiety, PTSD
  - Medication Overuse
- Look for Malingering/Compensation Issues
- Understand and address patient’s questions & concerns
- Normalize, Impart Optimism
- Refer when appropriate
Pearls and Pitfalls in the Management of PTH?
Pearl #1

Most doctors don’t how
To diagnose and treat
Post-traumatic headache
Pearl #2

- Chronic Pain Clinics Are Usually a Very Good Option to Assist Individuals with Post-Traumatic Headaches
Pearl #3
Pain Does NOT Need to be Medicated to 0/10
Medications for Headache Can CAUSE More Headaches

- Simple analgesic >15 days/month
- Combination meds >10 days/month
- Opiods >10 days/month
- Ergotamine >10 days/month
- Triptans > 10 days/month
Pearl #4

There are published guidelines to assist doctors when treating a patient with PTH

- Ontario Neurotrauma Guidelines for the Management of Persistent Symptoms Following Concussion / mTBI
Pearl #5
The Pendulum Has Swung Too Far Towards Rest

This means...

- NO sports
- NO school work
- NO screens
- NO computers
- NO video games
- NO TV

REST your injury!
Pearl #6
Concussion Has Become a Business – This is Disgusting and You Must Be Part of the Solution
Pearl #7 - The Person To Whom the Injury Happens Is The Most Important Factor
Concussion-Like Symptoms in Child and Youth Athletes at Baseline: What Is “Typical”?  

Anne Williams Hunt, PhD*; Melissa Paniccia, MSc†; Nick Reed, PhD*; Michelle Keightley, PhD*

*Bloorview Research Institute, Holland Bloorview Kids Rehab Hospital, Toronto, ON, Canada; †University of Toronto, Toronto, ON, Canada

Results: Common baseline symptoms for children were feeling sleepier than usual (30% boys, 24% girls) and feeling nervous or worried (17% boys, 25% girls). Fatigue was reported by more than half of the youth group (50% boys, 67% girls). Nervousness was reported by 32% of youth girls. Headaches, drowsiness, and difficulty concentrating were each reported by 25% of youth boys and girls. For youths, a higher total symptom
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, and Paul D. Berkner, DO
Figure. Rates of International Classification of Diseases, 10th Revision (ICD-10), Postconcussional Syndrome Classification in High School Athletes With No Recent Concussion (Mild or Greater Symptoms in Each Domain)
Predictors of postconcussion syndrome after sports-related concussion in young athletes: a matched case-control study

RESULTS  PCS patients were more likely than control patients to have a concussion history ($p = 0.010$), premorbid mood disorders ($p = 0.002$), other psychiatric illness ($p = 0.039$), or significant life stressors ($p = 0.036$). Other factors that increased the likelihood of PCS development were a family history of mood disorders, other psychiatric illness, and migraine. Development of PCS was not predicted by race, insurance status, body mass index, sport, helmet use, medication use, and type of symptom endorsement. A final logistic regression analysis of candidate variables showed PCS to be predicted by a history of concussion (OR 1.8, 95% CI 1.1–2.8, $p = 0.016$), preinjury mood disorders (OR 17.9, 95% CI 2.9–113.0, $p = 0.002$), family history of mood disorders (OR 3.1, 95% CI 1.1–8.5, $p = 0.026$), and delayed symptom onset (OR 20.7, 95% CI 3.2–132.0, $p < 0.001$).
Pain Catastrophizing Correlates with Early Mild Traumatic Brain Injury Outcome

Geneviève Chaput,¹ Susanne P. Lajoie,² Laura M. Naismith,³ and Gilles Lavigne⁴
How Do You Treat PTH?

1. Education & Goal Setting

2. Screen for and treat co-morbidities
   – Mood, Anxiety, Insomnia

3. Non-pharmacologic!!!
   – Lifestyle strategies
   – Mindfulness, Relaxation
   – Psychotherapy, CBT
   – Physical

4. Medical
   – Acute
   – Prophylactic
   – +/- Interventional
ACUTE MEDICATIONS

Nonspecific
- NSAIDs, Acetominophen, ASA
- Combination analgesics (with caffeine)
- AVOID T#1, T#2, T#3, Percocet, Oxycocet !!!
- AVOID Tramacet, Tramadol, Oxycontin, Fiorinal !!!

Migrainous
- Triptans
- Anti-emetics
ACUTE MEDICATIONS

Over-the-Counter:

- Advil or similar ≤ 3 days per week
- Tylenol ≤ 3 days per week
- Aspirin/Alka-Seltzer ≤ 3 days per week
- Obey daily limits!
- Alternate OTC analgesics
- Combine Alka-Seltzer/ASA/Advil with Tylenol to avoid excessive consumption of any 1 analgesic
ACUTE MEDICATIONS

**Triptans**

- ≤ 10 days per month
- Axert 12.5 mg, Maxalt 10 mg, or Relpax 40 mg
- Wafer (Maxalt/Zomig),
- Nasal Spray (Imitrex, Zomig), Injection (Imitrex)
- May combine with NSAIDs/ASA
- May combine with anti-emetics (Gravol, Metoclopramide, Ondansetron)
When Should Prophylactic Therapy Be Considered?
GOALS OF PREVENTIVE TREATMENT

- Decrease attack frequency intensity, and duration
- Improve responsiveness to acute $R_x$
- Improve function and decrease disability
Preventive Medications

- **Antidepressants**
  - TCAs (amitriptyline, nortriptyline)

- **Beta blockers**
  - Propranolol
  - Nadolol

- **Anticonvulsants**
  - Topiramate
  - Gabapentin

- **Interventional**
  - Botulinum toxin A (BOTOX)
  - Nerve Blocks

- **Neutraceuticals**
  - Riboflavin, Magnesium
  - Melatonin

- **Miscellaneous**
  - Sibelium
  - Sandomigran
Pearls for Preventing Headache

- Prescribe reality
- Primum non nocere
- Try for “two for’s”
- Start low; go very slow
- Persist, persist, persist
Amitriptyline/Nortriptyline

**PRO**
- Old
- Inexpensive
- Effective
- Helps with sleep and neuropathic pain

**Con**
- Obesity
- Sedation
- Postural lightheadedness
- Constipation
- Dry Mouth
- Cardiac arrhythmias
- Glaucoma
- Urinary Retention
Topiramate (Topamax)

PRO
- Effective (primarily migrainous headache)
- Weight loss

Con
- Cognitive and language difficulties
- Paresthesias
- Weight Loss
- More expensive
Beta-Blocker

PRO
- Old
- Inexpensive
- Effective (migrainous, exertional)

Con
- Hypotension
- Low heart rate
- Postural light-headedness, pre-syncope
- Exercise Intolerance
- Sexual dysfunction
- Weird dreams
BOTOX Pros & Cons

**PROS**
- No meaningful side-effects
- Once every 3 months
- No daily medications
- Compliance
- Evidence

**CONS**
- Injections
- Toxins and Fear
- Cosmetic Bias and MOA uncertainty
- Lack of Access
- Lack of Awareness
PTH and the Future
CGRP — The Next Frontier for Migraine

Andrew D. Hershey, M.D., Ph.D.
Development of CGRP-dependent pain and headache related behaviours in a rat model of concussion: Implications for mechanisms of post-traumatic headache

Dara Bree¹,² and Dan Levy¹,²
PTH is real and, for a minority, can be long-lasting!

- 20 year old female
- Club-level gymnast
- Vault injury
- Constant 24/7 headaches for 5 years
How Do You Approach PTH?

- Take a Good History
- Review Medical Brief and Obtain Ancillary Info
- Screen For and Address
  - Insomnia, Depression, Anxiety, PTSD
  - Medication Overuse
- Look for Malingering/Compensation Issues
- Understand and address patient’s questions & concerns
- Normalize, Impart Optimism
- Refer when appropriate
A Team-Based Approach is Optimal to Evaluate and Manage Persisting Symptoms Following mTBI
Neurology Service & CIOR at TRI

- Neurologist
- Psychiatrist
- Physiatrist
- Neuropsychologist and Psychology
- Psychometrist
- Occupational Therapist
- Physiotherapist
- Neuro-otologist (ENT)
- Neuro-ophthalmologist
- Sleep Medicine
- Neurosurgery
- Diagnostic Investigations (Neuroimaging, Sleep Study, EMG/NCS, EEG)
- Speech-language pathology
- Kinesiology
- Pharmacist
QUESTIONS?