POST TRAUMATIC HEADACHES

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Post Traumatic Headache

“He thrust unto him with his horse, and smote him on high on the helm, a great stroke, and astonied him sore” (Malory Morte D’Arthu)

Little mention of headaches in ancient epics—plenty” falling into swounds”
Post Traumatic Headache

1861 Waller Lewis- headaches, sleep disturbances, tinnitus, spinal pain and tenderness in absence of signs.

Erichsen (1866) “On railway spine and other injuries of the nervous system”

Gowers (1886) persistent pain caused by a state of sensitization of the nerves which persists despite “the sovereign balm” of compensation.
Charcot (1889) manifestations of hysteria, ”psychonervous commotion”

Oppenheim (1901) “traumatic neuroses” the combination of psychic and physical induced “molecular alterations”

Mitchell (1866) “and felt no more in heart and brain the weary weight of sin and pain”- described neuropathic pain

Freud (1905) the train is a metaphor for sex
Chronic Traumatic Encephalopathy - CTE

Normal

Advanced CTE

Courtesy Ann McKee, MD, Boston University Alzheimer's Disease Center
Post Traumatic Headache

Henry Miller (1961)
No one returns to work before settlement
Never occurs if no hope for compensation
Never follows severe head injury
Never occurs in professionals
Patients symptom free after compensation
Never occurs in sports injuries
Post Traumatic Headache

Reginald Kelly (1975, 1981)
76% returned to work pre settlement
79% were professionals
46% severe injury
26 of 151 back at work at time of settlement
Post Traumatic Headaches

- ICHD criteria: headache occurring within 7 days of injury—but?
- Acute or chronic with the same phenotypes as primary headaches
- The head has a limited number of ways it can express itself to us to gain our attention
Post Traumatic Headache

- Tension Type Headache
- Migraine w/o aura
- Cluster Headache
- Other Trigeminal Autonomic Syndromes
Migraine Without Aura

- 5 recurrent headaches
- Lasts 4 to 72 hours
- With 2/4
  - Unilateral
  - Pulsating (throbbing) quality
  - Worsening of the headache with movement
  - Moderate to severe
- Accompanied of 1/2
  - Nausea or vomiting,
  - Aversion to light, sound and/or osmophobia
- Not attributed to another disorder
Post Traumatic Headache

- Acute PTH associated with moderate or severe head trauma (5.1.1)
  - A Headache, no typical characteristics
  - B Head trauma: loc >30 mins, GCS <13, PTA>48 hours, imaging of a brain lesion
  - C Headache develops within 7 days post trauma or after regaining consciousness
  - D One or other of the following; 1) Headache resolves within 3 months, 2) Headache persists but 3 months have not passed
Post Traumatic Headache

Acute PTH attributed to mild head injury (5.1.1.2)

- **A**  Headache, no particular characteristics
- **B**  Headache with all of the following: 1) Either no LOC or LOC <30 mins duration, 2) GCS 13, 3) Symptoms and/or signs of concussion.
- **C**  Headache develops within 7 days after head trauma
- **D**  One or other of the following 1) Headache resolves within 3 months of the trauma, 2) 3 months have not yet passed.
Chronic Post Traumatic Headache

- Same criteria as for acute pth but persist for more than 3 months after trauma
- Can simulate any primary headache
- Mechanisms poorly understood.
Post Traumatic Headache

- **Symptoms:** Headache plus nausea, dizziness, vomiting, orthostatic and thermal dysregulation, neurasthenic depression, cognitive defects, irritability, photophobia.

- **TTH:** dull, pressing

- **Cervicogenic:** dragging, triggerable

- **Migrainelike:** pulsating

- **Cluster-type:** stabbing, pulsating, dragging
Post Traumatic Headache

Causes
MVA       42%
Falls     23%
Assaults  14%
Sports    6%
Post Traumatic Headache

- Postcraniotomy Headache
- Acute
- Chronic

More often after infratentorial procedures, prevented by osteoplastic procedures, not using fibrin, avoiding extensive drilling of IAC, duraplasty
Post Traumatic Headache

Case History
A 34 year old labour lawyer, accident Jan 23rd 1998. Hit head in occipital area. Pain started there and then generalised. Sleepy. No energy or concentration, right arm tremulous, irritable, some loss of smell. O/E mild nystagmus to left, tender back of neck and numb R occipital nerve distribution.

Rx Amitriptyline and Naprosyn
25th May 1999 - rear ended – daily headache
Botox every 3 months to present - good response
Post Traumatic Headache

Whiplash Associated Disorder

Grade 0: no complaints no signs
Grade 1: neck pain, stiffness, or tenderness
Grade 2: neck complaints + musculoskeletal signs, reduced neck mobility and/ or tender muscles
Grade 3: as above + neurological signs, reflexes, weakness, sensory deficits
Grade 4: fracture or dislocation
Post Traumatic Headache

Headache in WAD

Headache in 40-80% of acute Whiplash (Di Stefano 1995)

34% persistent neck pain within year of injury, 14% neck pain for more than 6 months (Bovin et al 1994)

3 years after injury headache in 82%, 46% occipital, 34% generalized, constant in 50% (Balla et al 1987)
Post Traumatic Headache

Pathophysiology
Peripheral damage to scalp, neck and jaw
Central disturbances
Secondary sensitization
Blood flow disturbances
Chronic Daily Headache

- Definition
- Classification
- Pathophysiology
- Relationship between Classification and pathophysiology
Headache Disorders Causing Chronic Headache

**Primary Headache**
- Chronic Migraine
- Chronic TTH
- Hemicrania Continua
- New Daily persistent Headache

**Secondary headache**
- Chronic Headache...head injury
- Chronic headache...whiplash
- Med Overuse
- Cervicogenic headache
- other secondary headache
Pathophysiology of Migraine

- Central sensitization of pain systems after repeated bouts of pain
- Damage to CNS pain modulating systems
- CNS changes secondary to med overuse
- Abnormal focal neuronal activity (CNS pain generators)
- Persistent activity in a peripheral pain generator
Focus had been on acute therapy to manage individual migraine episodes.

New advances in pathophysiology have transformed the concept of what migraine is:
- Migraine is a CNS disorder
- Genetic predisposition

This has paved the way for improved treatment:
- Treatment of migraine as a disorder
- Emphasis on preventive + acute
Pathophysiology of Migraine

The Genetic Basis

- **P/Q type Ca++ channel**
  - Presynaptic
  - Voltage gated
  - Occipital cortex
  - Trigeminal nucleus caudalis
  - Linkage to chromosome 19

- **Na-K ATP Pump**
  - Linkage to chromosome 1

Pathophysiology of Migraine

Hyperexcitable Cortex

- Migraineurs have a lower threshold for occipital cortex excitation than controls
- Genetic component:
  - P/Q calcium channel, Na⁺/K⁺ ATPase
  - Mitochondrial defects
- Probably due to:
  - Hyperactivity of excitatory neurotransmission
    - Na⁺, Ca²⁺ channels, glutamate
  - Lower activity of inhibitory neurotransmission
    - GABA

GABA=gamma aminobutyric acid.
Pathophysiology of Migraine

Trigeminovascular Migraine Pain Pathways

Preventive medication target

Central Sensitization

Pain Signal Transmission

Neuropeptide Release

Vasodilatation

Acute medication target

5-HT1B Receptors Vasoconstriction

5-HT1D Receptors Trigeminal Inhibition

Brain stem aminergic nuclei can modify trigeminal pain processing

PET demonstrates brain stem activation in spontaneous migraine attacks

Brain stem activation persists after successful headache treatment

Brain stem: generator or modulator?

PET=positron emission tomography.
Pathophysiology of Migraine

Red Nucleus and Substantia Nigra

Sagittal View of Imaging Plane

Pathophysiology of Migraine
Iron Homeostasis

Pathophysiology of Migraine

Disease Progression: Changes in PAG

- Changes observed over time in the PAG—center of the brain’s powerful descending analgesic neuronal network
  - Iron deposition
  - Secondary to free-radical cell damage during migraine attacks
- Degree of PAG structural alteration depends on duration of headache history, not the age of the patient
  - Repeated migraine attacks, repetitive damage, decreased threshold for further migraine attacks

Pathophysiology of Migraine

Central Sensitization

- Migraineurs develop increased sensitivity to stimuli due to increased nerve excitability.
- 79% of migraine patients suffered from cutaneous allodynia during attacks due to central sensitization.

CHRONIC DAILY HEADACHE

A Primary Headache Syndrome

*(Organic causes of headache are excluded)*

- Occurs 15 days a month
- Lasts 4 hours a day
Post Traumatic Headache

Risk factors for chronification
Previous headache, sex (f>m 49% v 30%)
Mild injury
Abnormal position of head at impact
   (bobblehead model)
Low socioeconomic status, alcohol, early symptoms in ER
Litigation
Post Traumatic Headaches

- Factors for Chronification of Migraine: female sex, obesity, sleep apnea, low socio economic status, initial frequency of headache
Post Traumatic Headache

Investigation

Examination: Neurological exam as well as neck and vestibular system

Imaging: rarely very useful but important to exclude coexistent features, eg. Chiari acute low CSF pressure (Miyazawa 2003)
Post Traumatic Headache
Post Traumatic Headache

Treatment

Headaches are heterogeneous so treatment strategy is aimed at the particular type of headache, i.e., TTH or migraine symptomatically.

Does aggressive symptomatic and prophylactic treatment reduce chronification? No evidence either way.
Treatment of WAD

No universally accepted guidelines

Physio, chiro, exercise etc: no evidence

Diagnostic blocks with radiofrequency neurotomy may help (Bogduk 1997)

Onabotulinum Toxin A (Freund and Schwartz 2000)
NONPHARMACOLOGIC TREATMENT FOR CHRONIC DAILY HEADACHE

Enable healthful patient behavior:

Education

Reduce medication overuse, treat rebound headache

Discontinue smoking

Regulate eating and sleeping patterns

Exercise

Biofeedback and behavioral treatment

Other psychotherapeutic interventions
Double-blind, placebo-controlled published studies in CDH

- Topiramate
  - Silvestrini et al. Cephalalgia, 2003 (n=28)
- Tizanidine
  - Saper et al. Headache, 2002 (n=136)
- Gabapentin
  - Spira et al. Neurology, 2003 (n=133)
- Fluoxetine
  - Saper et al. Headache, 1994 (n=64)
- BoNTA
  - PREEMPT (Diener et al 2010)
Post Traumatic Headaches

- New perspectives from Iraq and Afghanistan (Theeler et al 2012)
- Combination of ‘normal’ injury and blast injury related to IEDs and better body armour. Higher incidence of head injury.
- Reviewed 978 US soldiers who scored positive for deployment related concussio
Post Traumatic Headache

- 20% of US servicemen with a history of concussion manifest as CDH. Incidence in population is 4%.
- When headaches develop within a week of concussive event they can be classified as PTHA according to IHCD-2 criteria.
- Chronic migraine is the predominant headache syndrome in soldiers with posttraumatic CDH
Post Traumatic Headaches

- Soldiers with CDH twice as likely to screen positive for PTSD as soldiers with episodic headaches
- 41% of soldiers with CDH screened positive for PTSD
- Migraine is the headache phenotype in 66% of soldiers with CDH
Post Traumatic Headache

Post Traumatic Headache

Conclusions

Post traumatic headache is common but is often poorly treated and overly assessed. Try to get a clear description of the type of headache and apply IHS Classification. Treat appropriately to the Classification. Use acute and prophylactic therapy, consider Botox.