CONCUSSION DIAGNOSIS AND MANAGEMENT

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Conflict of Interest

- I have no financial relationships with a commercial entity producing healthcare-related products and/or services.

Case 1: “Beth”

- 35 year-old woman in a car accident
- Hit head on dashboard, airbags deployed
- Bystander came to window, patient unconscious
- Came to but confused per EMS
- Patient recalls driving, then recalls being in ED

Beth

- Head CT negative
- In ED complained of headache and feeling foggy
- Told she had a concussion
- Sent home and told to rest until symptoms went away

At home had:

- Headaches
- Dizziness
- Fogginess/cognitive issues
- Neck pain

Beth: 2 Weeks Later

- Has the same symptoms
- Off work, in a dark room, no cognitive or physical activity
- Was this a concussion?
- Should she still be resting?
- How to manage her symptoms?

Case 2: “Molly”

- 35 year-old woman stood up quickly under a shelf at work
- No LOC, PTA or post-traumatic confusion
- Yelled “ow” and thought “I’m so stupid”
- Continued to do work activities
- Drove herself home

At home had:

- Headaches
- Dizziness
- Fogginess/cognitive issues
- Neck pain

Molly: 2 Weeks Later

- Still symptomatic
- Was this a concussion?
- Should she still be resting?
- How to manage her symptoms?

Concussion/Brain Injury vs. Head Injury

- Concussion is a temporary reduced consciousness state that *can be* associated with other signs:
  - Stopping breathing
  - Temporary loss of brainstem reflexes
  - Loss of muscle tone
  - Spasms that look like seizures (but aren't)
  - Too slow or too high heart rate
- Once normal consciousness resumes headache, nausea, dizziness, vomiting, malaise, restlessness, irritability and confusion may all be commonly experienced

Concussion Definition

- ACRM definition:
  - Glasgow Coma Score 13-15
  - Loss of consciousness < 30 mins, Post-traumatic amnesia < 24 hours, negative CT, no seizures
- AAN 1997 definition:
  - graded based on LOC, PTA and post-traumatic confusion
- Zurich Conference 2012: pendulum too far – all head injuries plus symptoms could be concussion

Concussion Mechanics

- Lots of studies done to figure out how concussions occur
- Denny-Brown and Russell used cats, hit them with a pendulum-like device, if head allowed to bobble, cats lost consciousness; if head kept stable, concussion difficult to cause
- Ommaya and Gennarelli used squirrel monkeys to prove the same thing: rotational acceleration caused loss of consciousness; linear acceleration showed no loss of consciousness

Concussion Epidemiology

- Epidemiology
  - 1.5-2.0 million civilians/year
  - bimodal age distribution – young adults and elderly
  - Alcohol commonly involved
- Causes of injury
  - The usual various vehicles and pedestrians
  - Falls > 180 cm/ 5 feet
  - Assaults and falling objects

Imaging in Concussion

- By definition, imaging should be normal in concussion
- Imaging should only be done to rule out neurosurgical emergencies
- Patients with concussion need a head CT if they:
  - Don’t get back to normal mental status in 2 hours
  - Have signs of a skull fracture
  - Vomiting
  - Age > 60
  - Dangerous mechanism of injury or trauma above collar-bones
  - Severe headache
  - Are intoxicated
  - Have seizures

What About Anticoagulation?

- No accepted protocol for anticoagulation post-concussion
- Some studies suggest if patient is anticoagulated and GCS is 15 no additional risk of hemorrhage compared to non-anticoagulated (Ucella et al World Neurosurgery 2018).
- But same studies show antiplatelets give increased risk.
- When in doubt – head CT

Back to Beth and Molly

- Do Beth and/or Molly have a concussion?
- Should Beth and/or Molly still be resting?
- How should we manage each of their symptoms?

- Both were told:
  - they had a concussion
  - to rest until symptoms resolved
  - both have similar symptoms

Why Rest May Be Important

- Concern that in the early period of recovery, energy demands of activity might increase neurological injury, though no direct evidence in humans.
- While recovering coordination, reaction time and attention reduced, creating risk for additional injury – mostly athletes.
- Desire to avoid second concussion while recovering from the first.

What To Do About Rest

- Many guidelines recommend physical and cognitive rest until symptoms resolve, but this is likely too cautious.
- Removal from activity itself can lead to many of the non-specific symptoms associated w/ concussion.
- As recovery progresses, somatic symptoms of concussion improve, emotional symptoms worsen, often due to prolonged rest.
- We recommend a period of rest lasting 3-5 days after injury, followed by a gradual resumption of both physical and cognitive activities as tolerated, remaining below the level at which symptoms are exacerbated.

Rehab stage	Functional exercise	Objective
No activity	Complete rest	Recovery
Light aerobic	Intensity <70% MHR; no resistance	Increase heart rate
Sport-specific	Skating, running, etc – no head impact	Add movement
Noncontact training	More complex training, eg., passing drills, begin resistance	Exercise, conditioning, coordination, cognitive
Full contact training	Normal training	Confidence and skill assessment
Full return		

What about other symptoms?

- Post-Traumatic Headaches
- Dizziness
- Sleep Disturbance
- Emotional Symptoms
- Cognitive Issues

Post-Traumatic Headaches

- Most common sequelae of concussion
- PTH more common after concussion than after moderate or severe TBI
- Prior history of headaches, particularly migraine headaches, is known risk factor for development of PTH
- PTH further defined by headache type using the International Classification of Headaches Disorders criteria
- Migraines or probable migraines are most common type of PTH; then tension.
- No adequate evidence for recommendations for treatment

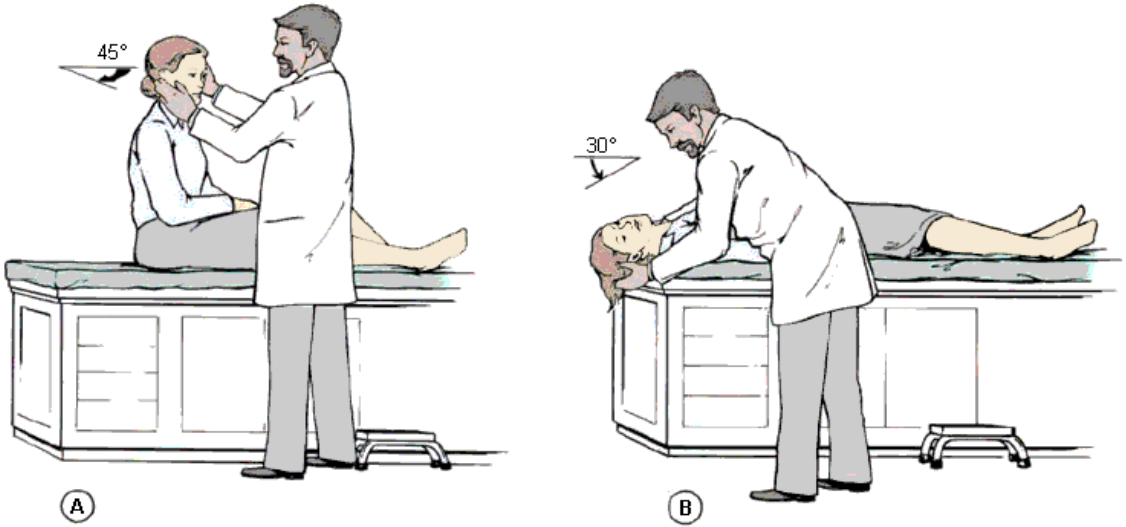
Post-Traumatic Headaches

- Overuse of OTC analgesics can lead to medication overuse headaches
- Early Rx of preventative medication can be helpful
- Pediatrics – rest and sleep hygiene etc. for 4-6 weeks before meds
- Treat like primary headaches type – i.e. migraines use migraine prophylaxis
- We typically use gabapentin 300mg QHS or nortriptyline 20mg QHS as first line agents
- Also, early use of ONB's and TPIs helpful

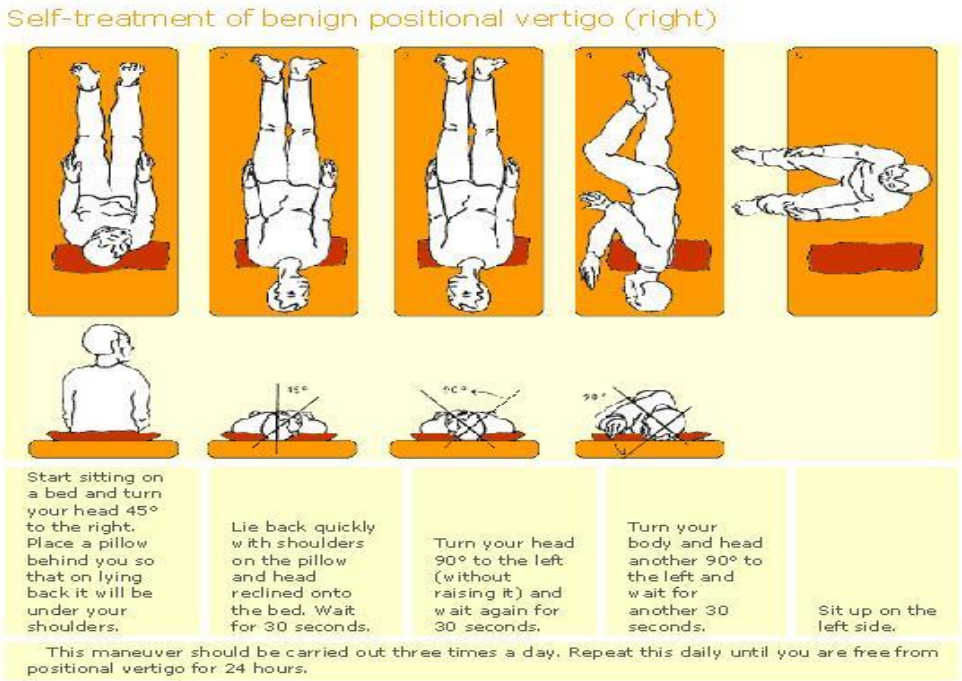
Dizziness

- Comes in many forms
- Orthostasis/lightheadedness – a/w cerebrovascular autoregulation; association between syncope and impaired autoregulation of cerebral blood flow
- Gradual return to exercise is most helpful
- Vertigo – usually BPPV – diagnosed with Dix-Hallpike, treated with Epley

Dix-Hallpike



Epley Maneuver



Activator.com Epley Handout https://www.activator.com/wp-content/uploads/Home%20Epley%20Handouts.pdf

Visual Issues

- Convergence spasm or convergence insufficiency very common after concussion
- Some studies estimate up to 69% of patients
- Interferes with tracking, contributes to disequilibrium
- Vestibular PT is the appropriate treatment

Sleep Disturbance

- Variable: insomnia, excessive daytime somnolence, and alteration of the sleep-wake cycle all seen
- First intervention: sleep hygiene education, gradual return to routine
- Second intervention: melatonin.
- With headaches nortriptyline/gabapentin can help sleep
- Trazodone if protracted sleep issues
- Avoid benzos – reduce arousal, impair cognition, exacerbate motor impairments

Emotional Symptoms

- Acute onset anxiety or depression common after concussion
- Abundant evidence that emotional effects of injury may be the most significant factor in recovery
- Preinjury history of anxiety a prognostic factor in recovery.
- Preinjury histories more likely to develop emotional symptoms after concussion, but may develop in anyone.
- Accident circumstances can lead to PTSD
- Injury and symptoms may have repercussions in many aspects of patient's life → further stress (e.g. loss of wages, inability to handle one's normal work load, school and family responsibilities etc.)

Emotional Symptoms

- Referral to a therapist – CBT preferable (psychologytoday.com)
- SSRIs and tricyclics may improve depression after TBI
- Avoid benzodiazepines

Cognitive Issues

- Patients complain about everyday experiences of forgetfulness, distractibility, loss of concentration, and mental fatigue.
- Program of gradual increase in mental activity, parallel to recovery of physical capacity, should be undertaken.
- Common in the first days or weeks after concussion, cognitive difficulties should not persist.
- When they do, consider concussion complication– headache, pain, sleep disturbance, anxiety

Cognitive Issues

- If prolonged despite improvement of other consider low-dose stimulant medications
- They should be only a temporary solution post-concussion
- If history of ADD prior to injury, could be continued.
- Many other medications used with less evidence than stimulants
- Cognitive Therapy programs have not been shown yet to improve outcomes

Prolonged Symptoms

- Approximately 10% of athletes have persistent signs and symptoms of concussion beyond 2 weeks.
- Non-sport–related concussion, most recover completely w/in first 3 months, but up to 33% may exhibit symptoms beyond that.
- There are four types of patients with persistent symptoms:
  - Sustained high force mechanism of injury
  - Sustained multiple concussions
  - Underlying neurological conditions – even age
  - Pain or psychological issues.

Word of Caution About Post-Concussion Syndrome

- Umbrella term for sx that *can* be seen after concussion, same sx exist in many PCP's offices, pain clinics etc.
- Iverson and al. in 2015, studying nearly 32,000 HS age athletes, 19% of boys and 28% of girls reported a sx burden resembling ICD-10 diagnosis of Post-Concussional Syndrome – WITHOUT having had a concussion.
- In another study, patients w/ depression w/out concussion, 90% met criteria for PCS when sx defined as mild, or 50% when mod/severe.
- Those w/pre-existing conditions more likely to endorse sx of PCS – 21-47% for boys and 33-72% for girls

Prolonged Symptoms

- Individuals with milder injuries (i.e. GCS 15, no LOC) tend to have higher return to work rates than those with more serious injuries (GCS 13-14 with LOC)
- Most patients return to work/school within one month post-injury
- Study following patients admitted to hospital with mTBI, 14.5% had at least one sx 1 year post-injury, < 5% had multiple sx (more than 4)
- In another study, 95% of patients with mTBI hospitalized reported at least 1 chronic pain issues (headaches, neck pain etc) 24 months post-injury

Patient Education

- Most important for patient education is reassurance.
- Concussion is meant to be a self-limited phenomenon
- Rest for 3-5 days, then resume gradual physical and cognitive activities
- If they overdo it, they may be symptomatic, then they should rest for a day and resume gradual return to activity
- If their recovery is prolonged (i.e. longer than six weeks), they likely need to be referred to a concussion specialist

In Summary

- Concussions are common
- If no LOC, PTA or PTC, probably just a head injury, not brain injury
- Rest for 3 days, then gradual resumption of activity
- For PTH, consider gabapentin

In Summary

- For dizziness and convergence issues send to vestibular PT
- For sleep issues, sleep hygiene, melatonin
- For prolonged cognitive symptoms consider low dose stimulant
- For emotional issues - CBT, SSRI (psychologytoday.com)
- If prolonged sx, but mild injury, most likely stress, mood, sleep or pain

In Summary

- Often reassurance is enough
- If you need help, refer to a concussion specialist

All references herein (unless stated on the slide of note) are taken from my review paper, Stillman et al. Concussion: Evaluation and management. Cleve Clin J Med. 2017 Aug;84(8):623-630

THE END

- Questions?

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