# Concussion

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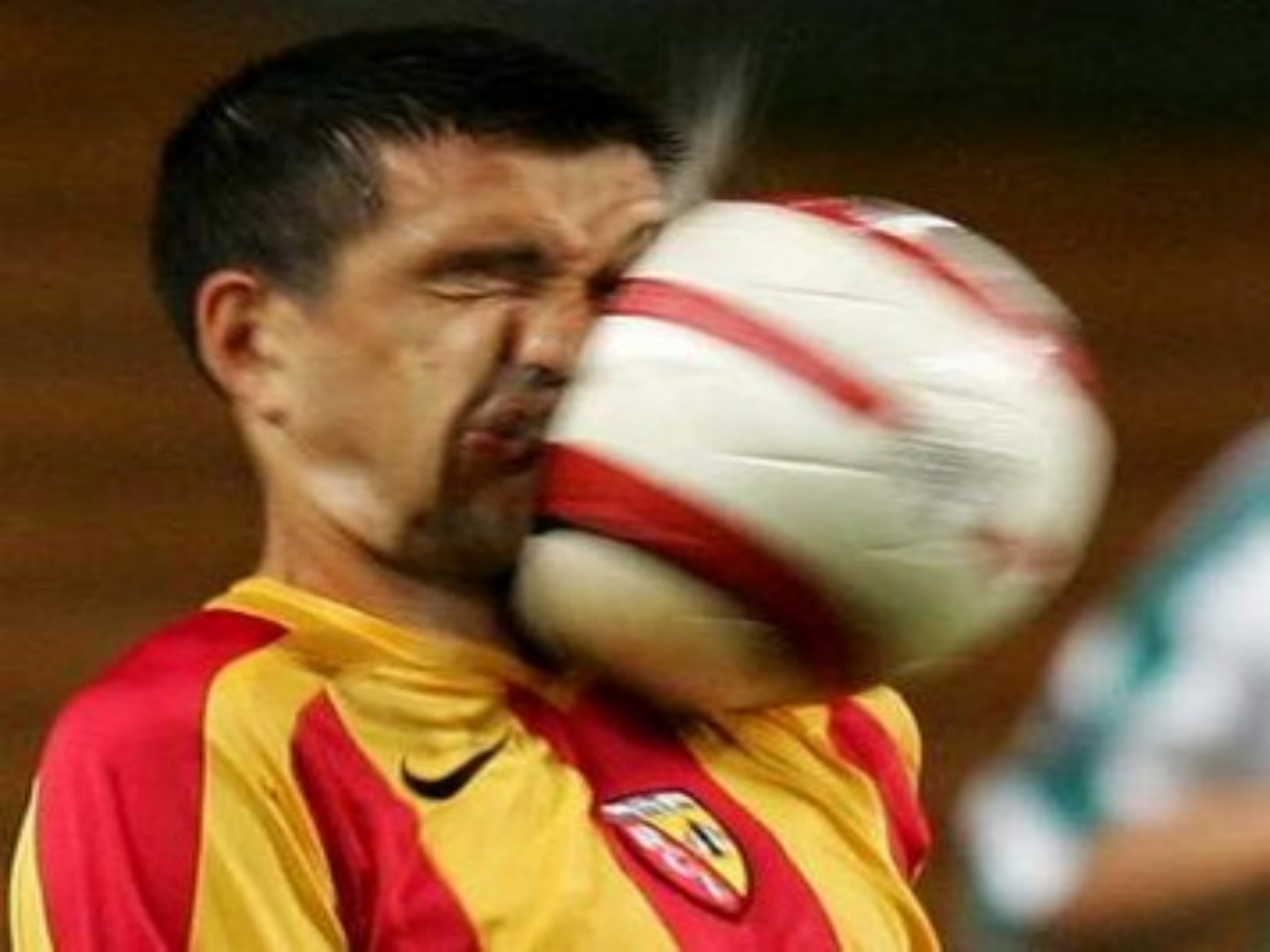
# Defintion

- Concussion is often used in the medical literature as a synonym for mild TBI
  - realistically it probably describes a subset of milder brain injury
- Quality Standards Subcommittee of the American Academy of Neurology defines concussion as:
  - A trauma-induced alteration in mental status that may or may not involve loss of consciousness.



# Zurich Guidelines for Concussion in Sport

- Concussion is defined[3] as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:
- 1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
- 2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.

- 3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
- 4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.
- 5. No abnormality on standard structural neuroimaging studies is seen in concussion

# Epidemiology

- majority of concussions in sports occur without LOC and are often unrecognized.
- annual incidence of sports-related concussion in the US 1.6 to 3.8 million
- likelihood of an athlete in a contact sport experiencing a concussion is as high as 20 percent per season
- estimated 10 percent of US college and 20 percent of US high school players sustain brain injuries each season

# What Basically Occurs

- Immediately following concussion:
  - Altered ionic fluxes into brain cells
  - INCREASED brain energy demand (hyperglycolysis)
  - Decreased cerebral blood flow…? Calcium mediated
  - Over time, as mismatch corrects, symptoms abate
- Cellular, not gross structure!!!

# Symptoms

- Hallmarks of concussion are confusion and amnesia
  - may be apparent immediately after the head injury or may appear several minutes later
  - amnesia almost always involves loss of memory for the traumatic event but frequently includes loss of recall for events immediately before and after

# Symptoms

- Early symptoms of concussion (within minutes to hours) include
  - Headache
  - Dizziness
  - vertigo or imbalance,
  - lack of awareness of surroundings
  - nausea and vomiting

# Symptoms

- Over the next hours and days, patients may also complain of
  - mood and cognitive disturbances,
  - sensitivity to light and noise
  - sleep disturbances
  - fatigue
  - fogginess

# Signs

- Vacant stare (befuddled facial expression)
- Delayed verbal expression (slower to answer questions or follow instructions)
- Inability to focus attention (easily distracted and unable to follow through with normal activities)
- Disorientation (walking in the wrong direction, unaware of time, date, place)
- Slurred or incoherent speech (making disjointed or incomprehensible statements)

# Signs

- Gross observable incoordination (stumbling, inability to walk tandem/straight line)
- Emotionality out of proportion to circumstances (appearing distraught, crying for no apparent reason)
- Memory deficits (exhibited by patient repeatedly asking the same question that has already been answered or inability to memorize and return three of three words and three of three objects for five minutes)

# What do you do in the office?

- History, history, history.
- PE: “the eyes don’t lie”, MSK
- Get rid of “the box” mentality
  - Individualize treatment according to the patient
  - Make accomadations to their activities to limit worsening and facilitate healing
    - May need vestibular PT
  - If you are making return to activity recommendations without repeated evalutaion, you are doing your patient a disservice
    - Cognitive first, then physical
- ImPACT testing – a tool

# Worst Case Scenario

- Diffuse cerebral swelling is a rare but generally fatal complication of mild head injury.
- The cause is hypothesized to be disordered cerebral autoregulation causing cerebrovascular congestion and malignant cerebral edema with increased intracranial pressure.
- “Second impact syndrome" is used when diffuse cerebral swelling occurs after a second concussion, while an athlete is still symptomatic from an earlier concussion.

# More Realistic Consequences

- Prolonged recovery and symptoms
- Postconcussion syndrome
  - Include HA, dizziness, neuropsychiatric symptoms, and cognitive impairment
  - Generally resolves within a few weeks to a few months

## Graduated return to play protocol

| Rehabilitation stage | Functional exercise at each stage of rehabilitation | Objective of each stage |
|---|---|---|
| 1. No activity | Complete physical and cognitive rest | Recovery |
| 2. Light aerobic exercise | Walking, swimming or stationary cycling keeping intensity <70 percent MPHR; no resistance training | Increase HR |
| 3. Sport-specific exercise | Skating drills in ice hockey, running drills in soccer; no head impact activities | Add movement |
| 4. Non-contact training drills | Progression to more complex training drills, eg, passing drills in football and ice hockey; may start progressive resistance training | Exercise, coordination, and cognitive load |
| 5. Full contact practice | Following medical clearance, participate in normal training activities | Restore confidence and assess functional skills by coaching staff |
| 6. Return to play | Normal game play | |

Six-day return to play protocol. Each day the athlete makes a stepwise increase in functional activity, is evaluated for symptoms, and is allowed to progress to the next stage each successive day if asymptomatic.

# A lot of unkowns

- 80% better within 30 days
- "magic number"
- Prevention
  - Bike helmets
  - Style of play
  - Early recognition
- Chronic Traumatic Encephalopathy
- Medications

# Take Home Points

- A lot of gray area.
- No return to play if symptomatic
- Assume cervical spine injury in unconscious players
- Athletes commonly do NOT recognize they have or have had a concussion
- Deteriorating LOC = bleed until proven otherwise
- When in doubt, err on the side of conservative management
- Individualize management!!!

# CONCUSSION

LOOK ON THE BRIGHT SIDE. FOR ONE BRIEF, GLORIOUS MOMENT, YOU FORGOT YOU WERE ON THE CUBS.

# References


1. UTD 19.2 Concussion and mild traumatic brain injury.
2. Practice parameter: the management of concussion in sports (summary statement). Report of the Quality Standards Subcommittee. Neurology. 1997;48(3):581.
3. Consensus Statement on Concussion in Sport 3rd International Conference on Concussion in Sport Held in Zurich, November 2008. Paul McCrory, MBBS, PhD, Willem Meeuwisse, MD, PhD, Karen Johnston, MD, PhD, Jiri Dvorak, MD,§ Mark Aubry, MD,k Mick Molloy, MB,¶ and Robert Cantu, MA, MD. Clin J Sport Med 2009;19:185–200