

Concussion: Scope of the problem, diagnosis, referrals

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Disclosures

- •Grant support from
 - •Brain Injury Association of America
 - •NIH



Learning Objectives

- •At the conclusion of this presentation, participants will be able to
 - Describe basic epidemiology and pathology of concussion
 - Discuss limitations in making a conclusive concussion diagnosis
 - Discuss why and when to make referrals for treatment



Epidemiology

- Incidence (increasing)
 - $\cdot 521/10^{5}(2001) 824/10^{5}(2010)$
 - •75% Mild
 - Increased risk for Age 0-4, 15-19 and ≥75
 - •2.5 Million Emergency Department visits
 - hospitalizations-deaths/year
 - •0-4 year-highest rated of ED visits
 - Prevalence
 - •3.2-5.3 million, 145K in pediatric (under-reported)





•Traffic Related •Highest rate 15-24 y/o

•Highest rate of mortality





- •Traffic Related •Falls
 - Increased incidence with end of age spectrums
 - Latest CDC data reports falls as most common cause
 - Highest risk:
 - 0-4
 - •75 and older





- Traffic Related
- •Falls
- Recreational
 - •Sports
 - Chronic Traumatic Encephalopathy
 - Incidence not clearly delineated
 - Reported under other categories



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Traffic Related

- •Falls
 - Increased incidence with advancing age
- CDC data reports falls as most common cause

Recreational

- •Sports
 - Chronic Traumatic Encephalopathy
 - Incidence not clearly delineated

•Blunt trauma

- •"struck by or against"
- •Most common in 0-4 year old group

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Traffic related

- •Falls
 - Increased incidence with advancing age
- CDC data reports falls as most common cause

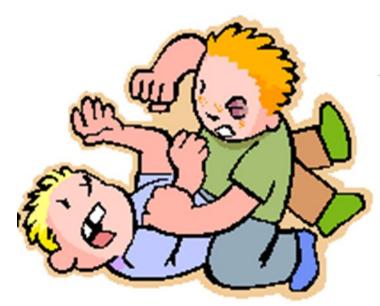
Recreational

- •Sports
 - Chronic Traumatic Encephalopathy
 - Incidence not clearly delineated

•Blunt trauma

Assault

- •More common in urban areas
 - Less than falls, traffic related and blunt trauma





•Abusive TBI

•Likely under-reported



Military Service

- Etiology
 - •Similar to other populations
 - •80% in non-deployed settings
 - •Blast exposure
 - DoD estimate
 235K 2000-2011





How Common are Sport Concussions in the United States?

- •Estimated up to 3.8 million occurrences/year
- Many are likely unrecognized, not reported or misdiagnosed



Are all injured athletes identified?

- •Talavage TM et al: J Neurotrauma 2010
- •High school varsity/JV football players
 - •Dx'd with concussion:
 - •Altered ImPACT and fMRI
 - •Not dx'd with concussion but high # or high magnitude collisions
 - •Altered ImPACT and fMRI



Diagnosis CONCUSSION DEFINITIONS



American Congress of Rehabilitation Medicine

- •Traumatically induced alteration in brain function, manifested by at least one of the following
 - Loss of consciousness
 - •Memory loss either before or after the event
 - •Feeling Dazed or Confused
 - •Focal neurological finding



Consensus Statement on Concussion in Sport: the 5th International Conference on Concussion in Sport Berlin 2016

A sport related concussion (SRC) is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature of a concussive had injury include:

caused wither by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head,

typically results in the rapid onset of short-lived impairments of neurological function that resolves spontaneously, However, in some cases, signs and symptoms evolve over a number of minutes to hours.

may result in neuropathological changes, but the cute clinical sign and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.

results in a range of clinical signs and symptoms that may or may not involve loss of consciousness, Resolution of the clinical and cognitive features typically follows a sequential course, However, in some cases symptoms may be prolonged.

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc.) or other comorbidities (e.g. psychological factors or coexisting medical conditions).



Concussion

- Complex process resulting from an impulsive blow-can be to body or head
- Any new neurological symptom like headache, dizziness, fogginess
- Loss of consciousness in less than 10%
- Nearly 4 million a year, may be an underestimation

Br J Sports Med 2005;39:196



RUSK REHABILITATION
Slide courtesy of Steven Galleta, MD

Definition: CDC 2003

 Impact or forceful motion (acceleration / deceleration) resulting in a brief alteration of mental status, such as confusion or disorientation, loss of memory for events immediately before or after the injury, or brief LOC <30 min

- □ More severe TBI are associated with extended periods of unconsciousness (more than 30 minutes), prolonged PTA (more than 24 hours), or penetrating skull injury.
- Observed signs of neurological or neuropsychological dysfunction

• Headache, dizziness, irritability, fatigue or poor concentration, when identified soon after injury, can be used to support the diagnosis of mild TBI, but cannot be used to make the diagnosis in the absence of LOC or altered consciousness.



Concussion Guideline Task Force: Executive Summary

A concussion is a change in brain function after a force to the head that may be accompanied by temporary loss of consciousness but is identified in awake individuals with the use of measures of neurologic and cognitive dysfunction.

Indicators of concussion, observed in alert (alert: Glasgow Coma Scale Score, 13 to 15) individuals after a force to the head, are the following:

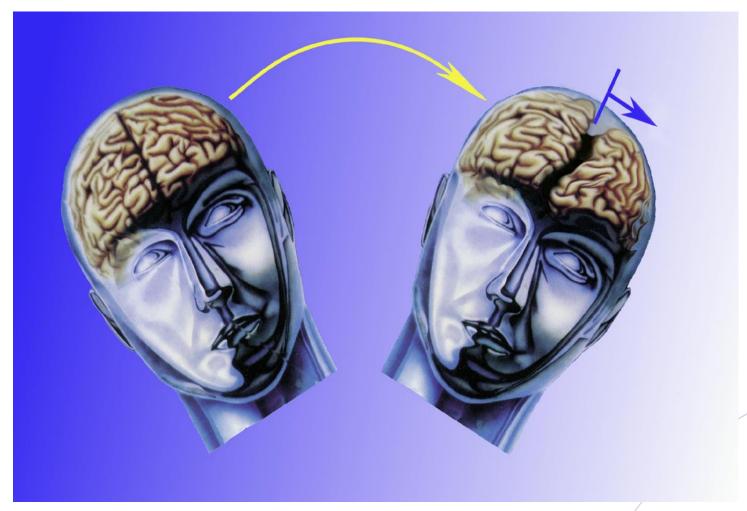
- Observed and documented disorientation or confusion (disorientation or confusion: loss of one's sense of direction, position, or relationship with one's surroundings) immediately after the event
- * Impaired balance (balance: a state of body equilibrium) within 1 day after injury,

* Slower reaction time (reaction time: the interval of time between application of a stimulus and detection of a response) within 2 days after injury, and

* Impaired verbal learning and memory (verbal learning and memory: the acquisition, retention, and retrieval of verbal material; memory of words and other abstractions involving language) within 2 days after injury.



Stretching the axons

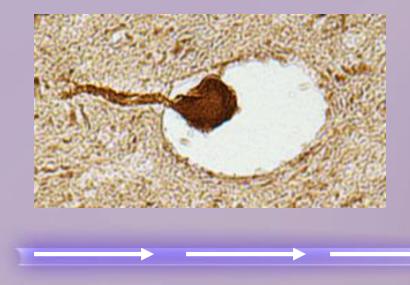


Axons-like telephone wires



CBIR

RUSK REHABILITATION Slide courtesy of Steven Galetta, MD



Axonal transport interruption, swelling and disconnection, like an Earthquake has occurred to a Highway- you get a big traffic jam



RUSK REHABILITATION Slide courtesy of Steven Galeta, MD

Pathophysiology

Children are different from adults

- Cerebral water content
- •Extent of myelination
- •Cerebral blood flow
- •Skull properties



CONCUSSION ASSESSMENT

You see what you look for, YOU LOOK FOR WHAT YOU KNOW



Clinical Presentation and Evaluation

History

- •Trauma to head or body
- Other factors to consider
 - Whiplash
 - Psychiatric
 - Previous concussions
 - Social

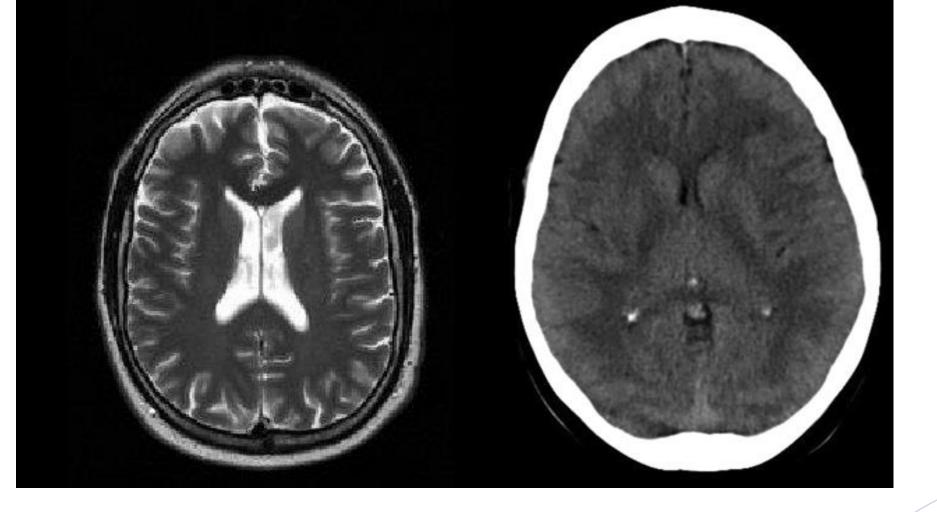
Symptoms

- Physical
- •Cognitive
- Behavioral

It should all make sense

You see what you look for, You look for what you know





No diagnostic test for concussion



SCAT3[™]

Sport Concussion Assessment Tool - 3rd Edition

Caller Time of History Date of Assessment,

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- Inquiret brain function (E.g. confusion) or Altraminal behaviour (E.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

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- Gaugew Corke alone less than 15
- Deterorating mental status
- Nextal genal stary Properties, advancing symptoms of new neurologic signs

Potential signs of concussion?

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COGNITIVE & PHYSICAL EVALUATION

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Physical Examination

SCAT 3

- Brief Neurological and MSK Examination
 - Brief cognitive screen
 - Balance
 - Coordination
 - Sensation
 - Limb strength

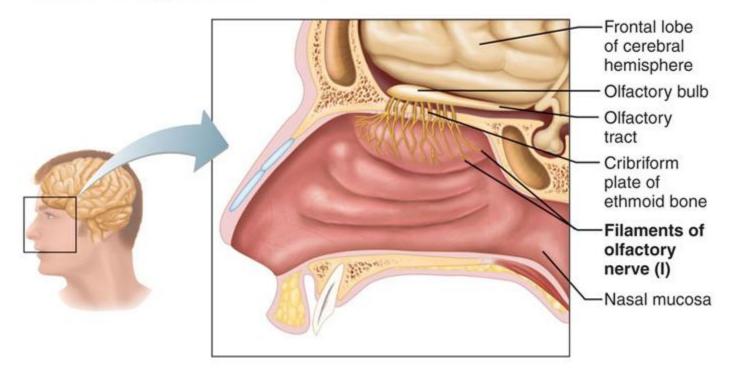
Deeper look

- Cranial Nerve
 I-XII
- •Visual
 - Rapid picture naming
- Vestibular
 - Dix-Hallpike



Anosmia

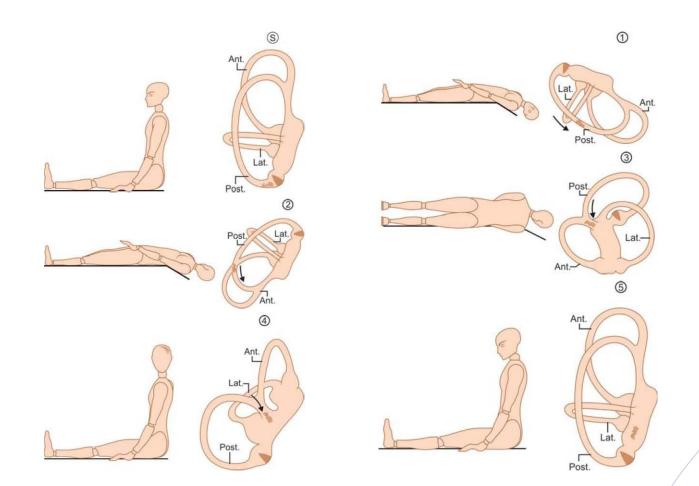
Olfactory Nerves - I



Loss of smell and taste



Benign Paroxysmal Positional Vertigo





Concussion Recovery

- Typically fairly rapid
- Watchful waiting
- To rest or not to rest
 - NO return to sport-related activity until medically cleared
 - Dr. Kerr to discuss Berlin Guidelines
 - Otherwise, activity as tolerated
 - Dr. Rieger to discuss return school, sports and beyond



Slower to Recover

- Consider
 - •Multiple concussions
 - Time course of previous injury(ies)
 - Cervical injury
 - Mood disorder
 - Endocrine Dysfunction
 - Social Stress



Referrals to consider

- Emergency Department
 - •Nausea, vomiting, marked arousal problems, focal deficits
 - Parents tend to know when their child is not right
 - Physical therapy
 - •Cervical spine, paraspinal and upper back musculature pathology
 - Vestibular therapy
 - Neuro-ophthalmology
 - Persistent visual complaints
 - Vision therapy
 - Psychology/Neuropsychology
 - Persistent cognitive difficulties
 - Supportive therapy
 - Accommodation plan for return to school
 - Neuroendocrine

Landone

- Emerging evidence of pituitary dysfunction
 - Not well studied in pediatric populations

Summary

- •TBI/Concussion is common
- •Small percentage of mild TBI develop chronic problems
- •Referrals as needed
 - Neurological change
 - •Treatment for those slow to recover
- •Much remains to be learned re:
 - Objective diagnosis
 - •Effectiveness of treatments
 - Proper identification
 - Definitions



Thank you!



