

HEAD INJURY & POST CONCUSSION SYNDROME:



Terminology

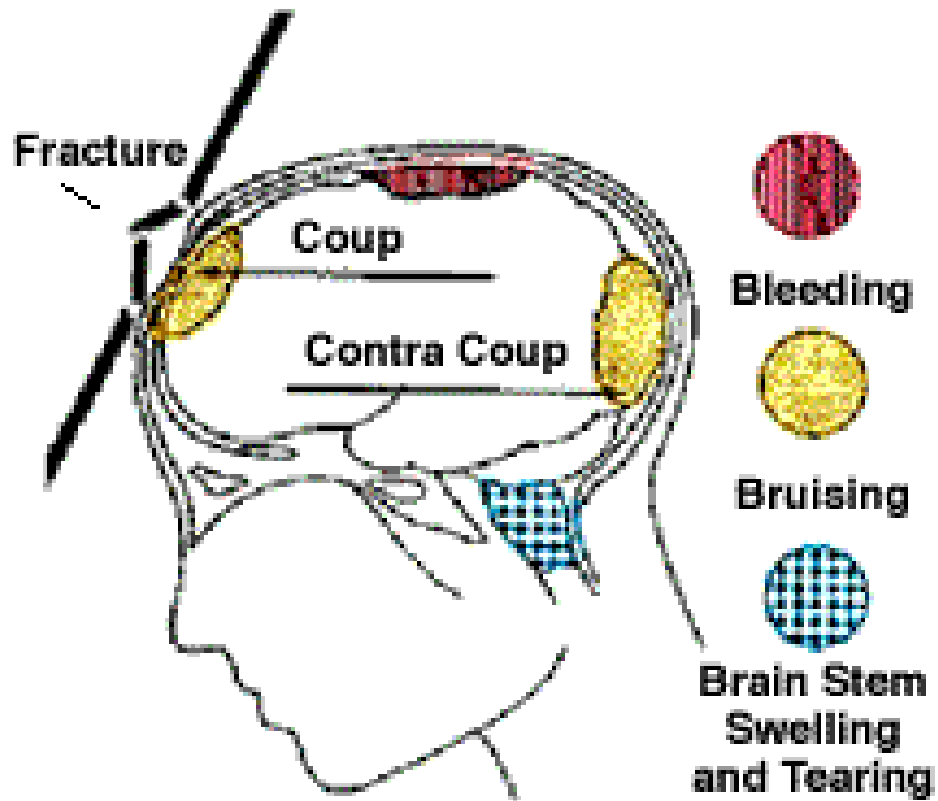
- Head Injury
- Brain Injury
- Traumatic Brain Injury
- Concussion

Head Injury



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Effects of TBI

- Direct
 - ▣ Skull fracture
 - ▣ Hemorrhages--epidural, subdural, intraparenchymal
 - ▣ Lesions to brain--contusion, laceration
 - ▣ Diffuse axonal injury [DAI]
- Secondary
 - ▣ Cerebral edema or swelling
 - ▣ Herniations of brain tissue
 - ▣ Infarction
 - ▣ Infection

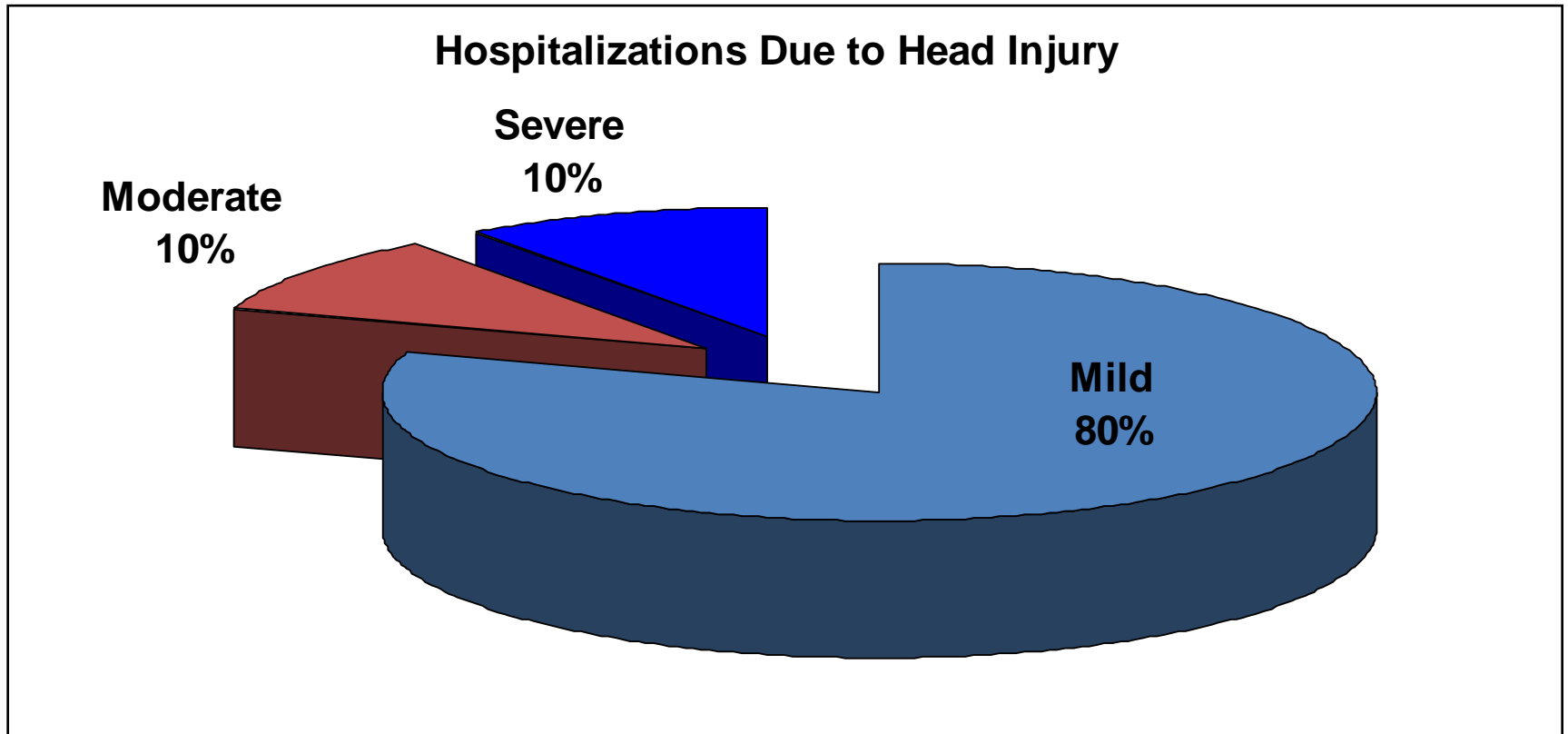
Measurement of Severity

- Duration of LOC (loss of consciousness)
- Duration of PTA (post traumatic amnesia)
- Duration of RA (retrograde amnesia)
- Glasgow Coma Scale
- Glasgow Outcome Scale
- Ratings of concussion severity

Defining Severity

Measure	Severity Classification		
	Mild	Moderate	Severe
Glasgow Coma Scale	13-15	9-12	3-8
Loss of Consciousness	< 20 minutes	20 min – 36 hours	> 36 hours
Posttraumatic Amnesia	< 24 hours	1-7 days	> 7 days

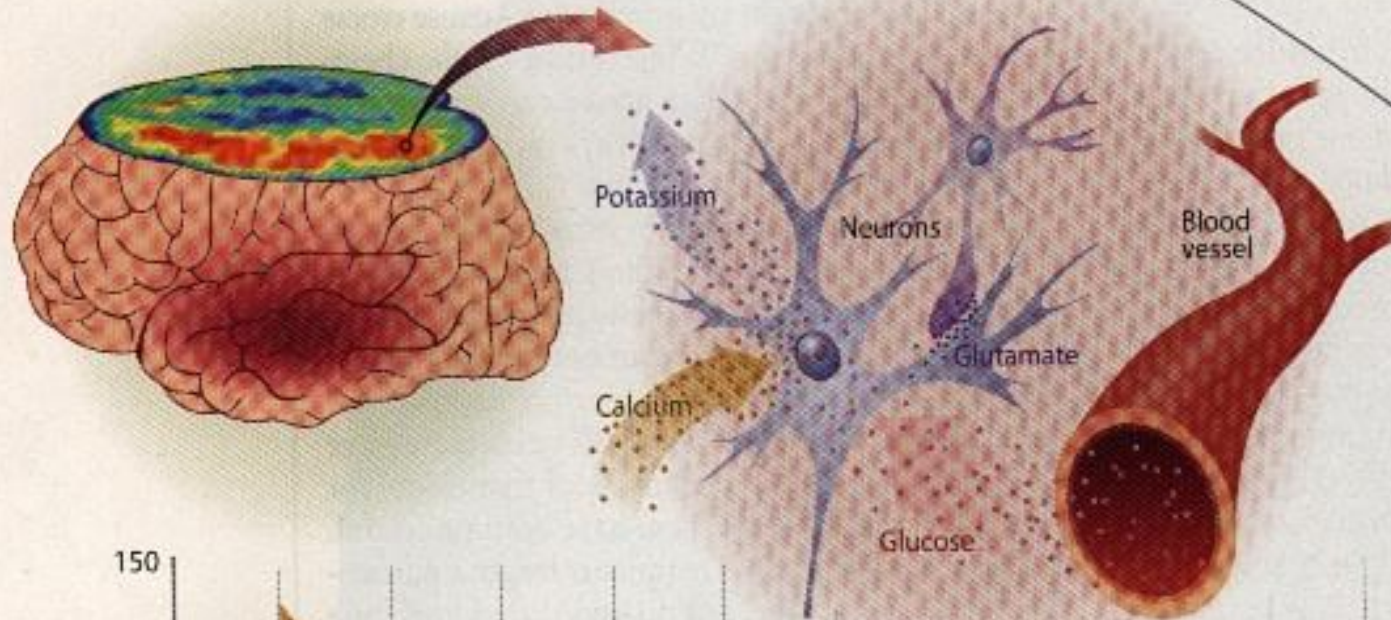
Defining Severity



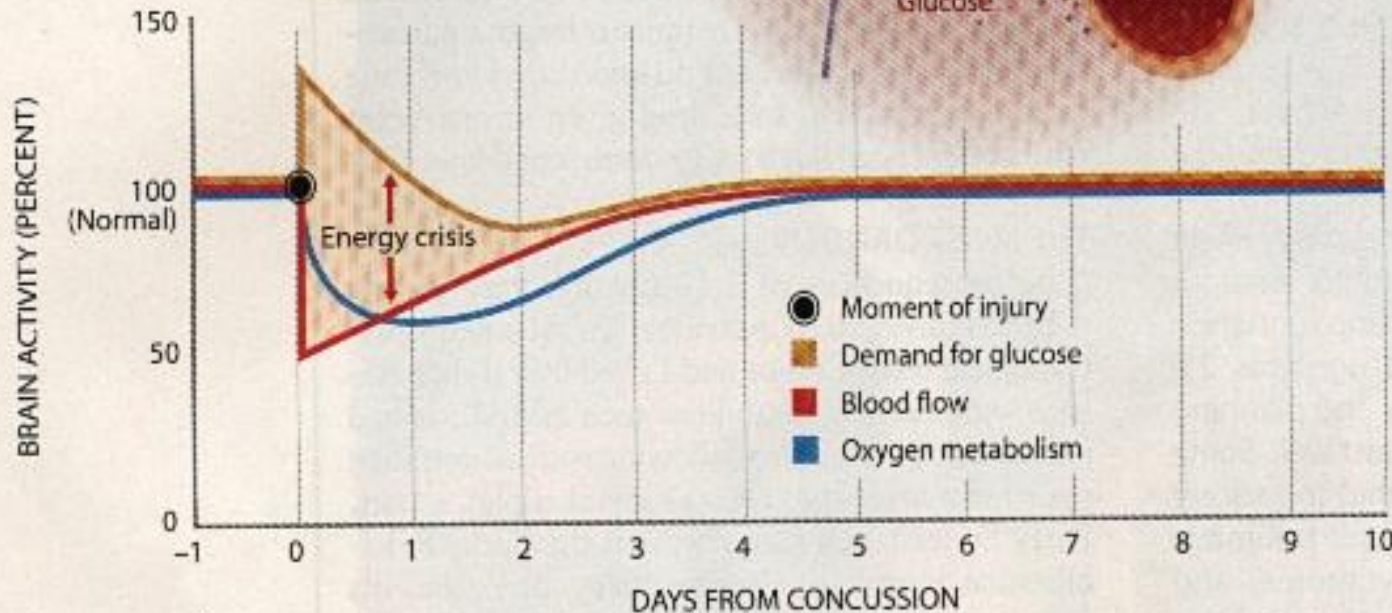
Key Distinctions

	<i>Moderate & Severe</i>	<i>Mild</i>
Definitions	Consistent, anchored in acute injury characteristics	Varied, symptom-based
Acute Injury Characteristics	Often clearly present and documented; strongest predictors or long-term outcome	Varied emphasis on LOC, PTA, mental status abnormalities, and of symptoms; limited correlation with outcome
Classification Systems	Tried and true methods for classifying injury severity; strong history of Glasgow Coma Scale (GCS) validity in grading injury severity and correlation with outcome	Traditional scales (e.g., GCS) of limited utility due to ceiling effect and limited sensitivity; GCS not initially intended for classification of MTBI; no specific tool for standardized assessment of MTBI
Neuroimaging Studies	Imaging studies of critical diagnostic importance to identifying neurosurgical emergencies; significant advances in both structural and functional neuroimaging of moderate and severe TBI, correlated with clinical measures and outcome	Usually negative or equivocal in overwhelming majority of cases; lack of “objective findings”
Natural History	Well defined and empirically-delineated	Not well-understood; limited to no consensus
Outcome	AIC’s best predictor of outcome	Most often predicted by non-injury factors such as premorbid psychosocial issues, psychological comorbidities, postinjury stressors, substance abuse, litigation
Persistent Disability	More clearly attributed to the severity, functional neuroanatomy of injury, and resulting impairments in most cases	Debate whether due to neurologic vs. psychological factors; etiology of Post-Concussion Syndrome unclear

Anatomy of a Concussion

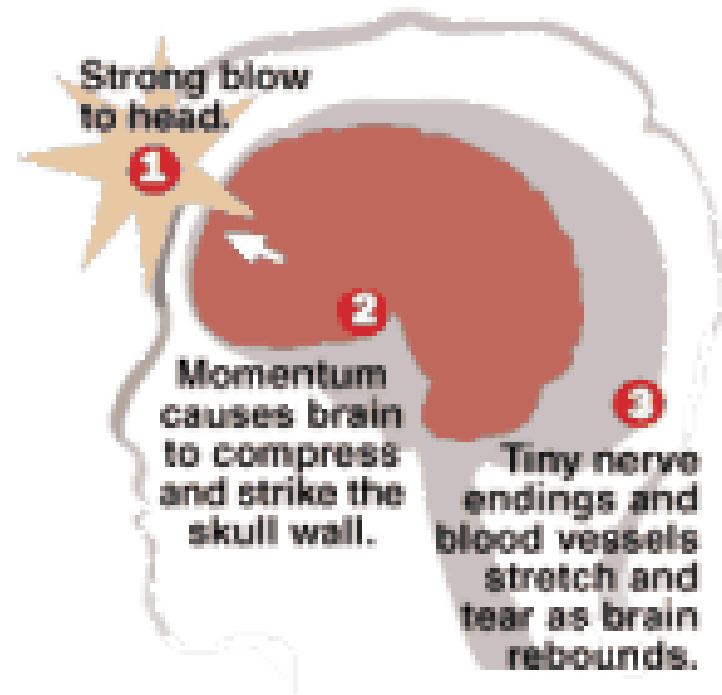


A blow to the brain sets off a flood of neurotransmitters such as glutamate. This prompts neurons to fire incessantly, causing an influx of calcium into the neurons and a release of potassium. To keep firing, the neurons demand extra energy, but the excess calcium reduces oxygen metabolism and thus the cells' ability to generate it. Meanwhile the wash of potassium constricts blood vessels, limiting the supply of new glucose fuel. The high energy demand, restricted blood flow and oxygen debt create an energy crisis that exhausts the neurons, leading to the mental confusion and failed memory of concussion. The brain may take days to restore the chemical balance that constitutes full recovery.



Symptoms of Concussion

- headache
- nausea
- difficulty with concentration
- depression
- reduced information processing speed
- fatigue
- irritability



Long term consequences: TBI

- Cognitive
 - attention
 - memory
 - information processing speed
 - higher executive function

Long Term Consequences: TBI

- Behavioural
 - irritability
 - childishness
 - reduced emotional & impulse control
 - denial/lack of insight
 - depression

Long Term Consequences: TBI

Depression & Suicide?

- Evidence of an association between TBI and depression and similarly compelling evidence of an association between TBI and aggression.
- Limited/suggestive evidence of an association between TBI and subsequent completed suicide, decreased alcohol and drug use compared to pre-injury levels, and psychosis.

Hesdorffer et al., 2009

TBI and Return to Work?

- Rates vary between depending on severity and time since injury
 - ▣ Severe 0-18%
 - ▣ Moderate – Mild 30-84%
- Van Velzen, et al, (2009)
 - ▣ 49 studies (1992-2008)
 - 40.7% at 1 year, (N=4709)
 - 40.8% at 2 years (N=276)

Mortality after TBI: Neurological

- 5.7% of 476 patients compared to 1.5% general population $p.001$ (Baguley et. al., 2000).
- 2-fold increase for mortality after moderate-severe TBI - 642 patients (Ratcliffe et. al. 2005)
 - ▣ Level of disability at discharge
 - ▣ Pre-injury characteristics

Reasons for Referral

- Evaluate improvement/deterioration
- Evaluate strengths & weaknesses
- Determine developmental learning disorder
- Detect neurological disorder
- Educational/rehabilitation/vocational planning
- Course & prognosis of deficits
- Competency

Domains of Function

- Attention
- Memory
- Language
- Motor/Information Processing Speed
- Visuo-spatial
- Executive function
- Social & emotional

Important Issues

- Life Span
- Recovery of Function
- Domains of Function
- Referral Questions
- Moderating Variables
- Approaches to Assessment
- Psychometric Properties

Why



- ❑ Financial gain
- ❑ Avoiding responsibility
- ❑ Gaining sympathy
- ❑ Obtaining medical psychological services
- ❑ Retaliation
- ❑ Cry for help

Features of Test Performance that raise question of Malingering

- a degree of deficit that is disproportionate to the severity of injury
- bizarre errors not typically seen in patients with genuine deficits
- patterns of test performance that do not make sense, e.g., doing as badly on easy items as hard items
- not showing expected patterns (e.g., scoring low on recognition; failing to show any learning at all on auditory learning; discrepancies between scores on tests measuring similar processes)
- Unusually high rate of “I don’t know”

Features of Test Performance that raise question of Malingering

- inconsistencies between test performance and real life behaviour (e.g., unable to repeat strings of digits or short sentences, but in general conversation able to respond to multi-stage instructions; extreme slowness in responding to test questions, but able to converse and provide history normally)
- inexplicable claims of remote memory loss even for important life events

Features of Test Performance that raise question of Malingering

- low performance on these that look hard but are in fact easy, e.g., Rey 15 item
- absence of severe depression or anxiety that might cause performance to deteriorate
- absence of improvement or deterioration of function over time
- below chance responding on forced choice tests

Test of Memory Malingering (TOMM)

- 50 line drawings, for 3 seconds each
- 50 two choice recognition items
- Examiner gives feedback each time
- Two learning trials
- One retention trial (no re-administration of target items)
- Scores lower than chance/scores lower than 45 on Trial 2 or Retention indicates possibility of malingering.