



# Traumatic Brain Injury – TBI

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## What is a Traumatic Brain Injury?

An acquired injury to the brain due to trauma

Closed - from a *direct* blow or jolt to the head

Open - from an object that *penetrates* the bones of the skull

Blast - from the rapid changes in *air pressure* due to an explosion; there may not be any direct contact with the skull



## Acceleration-deceleration injury

When the body comes to a sudden stop but the brain keeps moving inside the skull

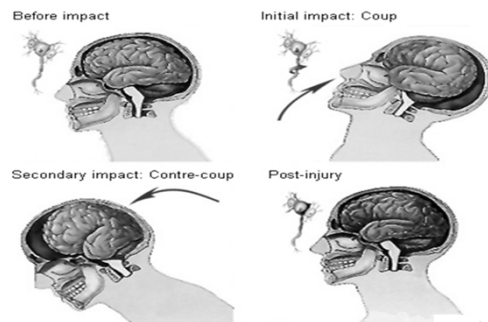
Two points of impact - the initial blow and the opposite side

Also called contre-coup

Common in MVAs, sports injuries, fights, falls



## What happens to the brain?



### Blast injuries

An injury caused by sudden drastic changes in the atmospheric pressure

Blast wave – an initial wave of very high pressure which pushes the brain inside the skull away from the direction of the blast, followed very quickly by

Blast wind – a wave of very low pressure which pulls the brain to the opposite side of the skull back towards the direction of the blast

These abrupt pressure changes of blast wave/wind cause the same type of brain injury as an acceleration/deceleration brain injury



### Axonal shearing/tearing

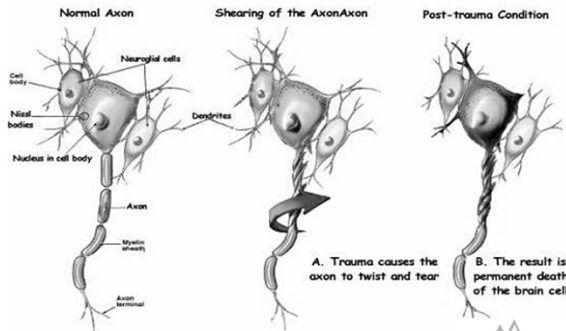
The force of the trauma can shear or tear the axon structure of the brain, causing cell damage or death

Takes place at the cellular level, may not be evident for days, weeks, or months after the injury

Blast injuries can have higher net force and twisting than conventional closed head trauma resulting in more axonal shearing/tearing



### Axonal shearing/tearing



### Delayed symptoms of TBI

Symptoms persisting after 7-10 days

May last 3 months to a year, or permanent

Symptoms dependent on what areas of the brain are damaged, and how much axonal shearing and cell death has occurred

Multiple areas of the brain can be affected

Damage is cumulative – the more blasts, the more severe the damage



**Cognitive deficits**

- Judgment, insight, abstract reasoning
- Follow-through
- Delay in or absence of processing information
- Memory, short and/or long term
- Rigid thinking, paranoia
- Learning new routines



**Emotional deficits**

- Depression, apathy
- Anxiety
- Irritability
- Mood swings
- Anger/rage outbursts
- Personality changes



**Behavioral/motor deficits**

- Impulsivity, inappropriate behaviors
- Sleep problems
- Poor social skills
- Restlessness, boredom
- Coordination, balance
- Fine motor skills



**Sensory deficits and other symptoms**

- 10% have problems with vision, including visual hallucinations
- Ringing in the ears, hearing problems
- Problems with smell, taste, touch less common
- Persistent headache
- Seizures



## **PTSD and TBI**

Combat veterans frequently have both conditions with multiple overlapping symptoms, differential diagnosis may be difficult and require complex treatment strategies

PTSD alone – cognitive, emotional and behavioral symptoms can be similar but not usual to see sensory or motor symptoms of TBI in PTSD alone

TBI – cognitive, emotional and behavioral symptoms can be similar but not usual to see avoidance, re-experiencing or hyper-arousal symptoms of PTSD in TBI alone



## **Treatment**

The sooner treatment starts, the better the prognosis

Focuses on addressing symptoms

May include PT, OT, speech therapy

May include psycho-therapy and family therapy

Multi-disciplinary treatment team approach found to work best

Medications – generally not found to be helpful  
 Anti-depressants if depression is co-occurring  
 Anti-seizures meds if seizures are chronic



## **References and Resources**

Brain Injury Association of America

<http://www.biausa.org/>

Defense and Veterans Brain Injury Center

<http://www.dvbic.org/>

Mayo Clinic – Traumatic Brain Injury

<http://www.mayoclinic.com/health/traumatic-brain-injury/DS00552>

National Institute of Neurological Disorders and Stroke

<http://www.ninds.nih.gov/disorders/tbi/tbi.htm>

Traumatic Injury Survival Guide

<http://www.tbiguide.com/>

