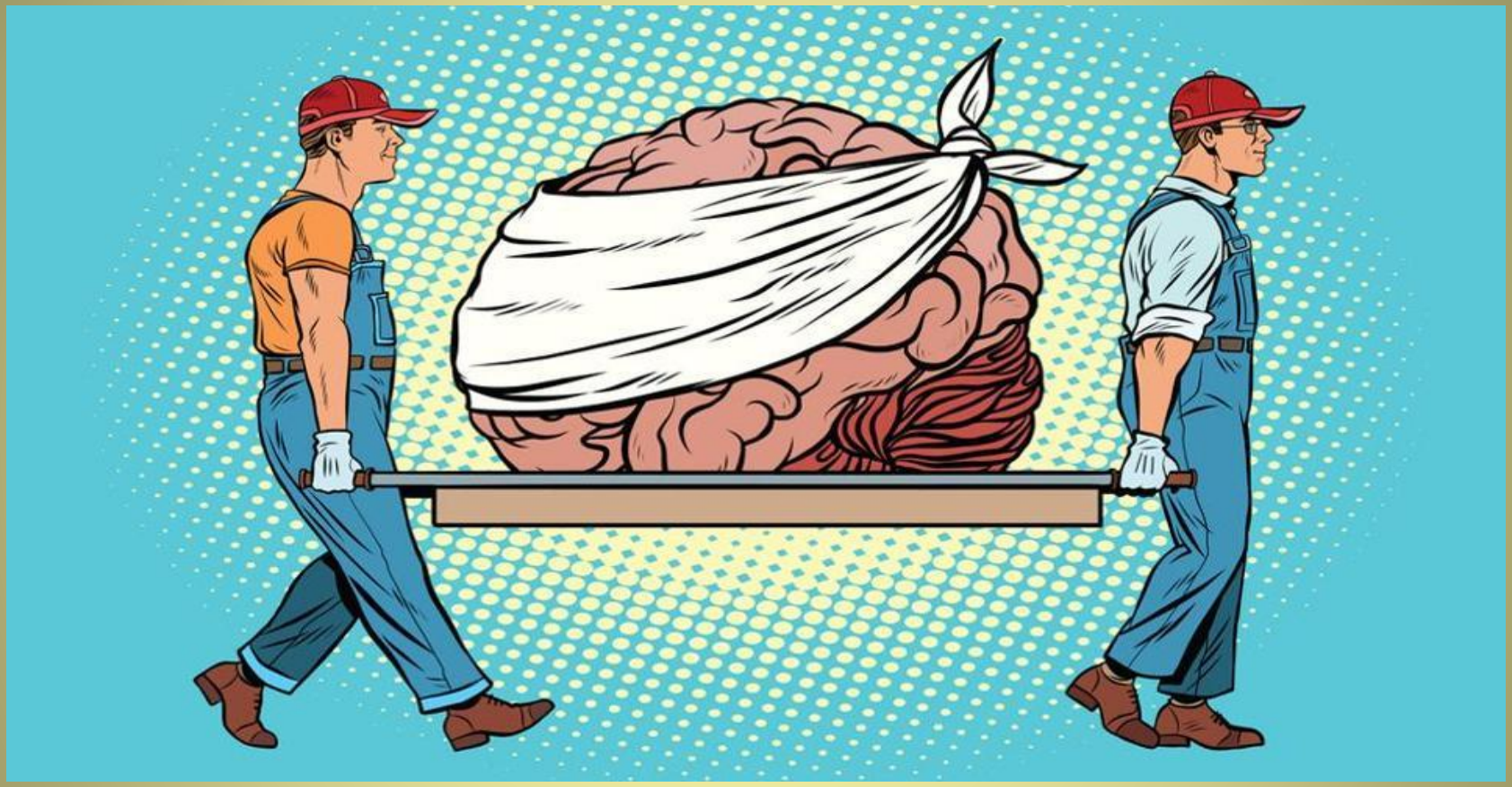
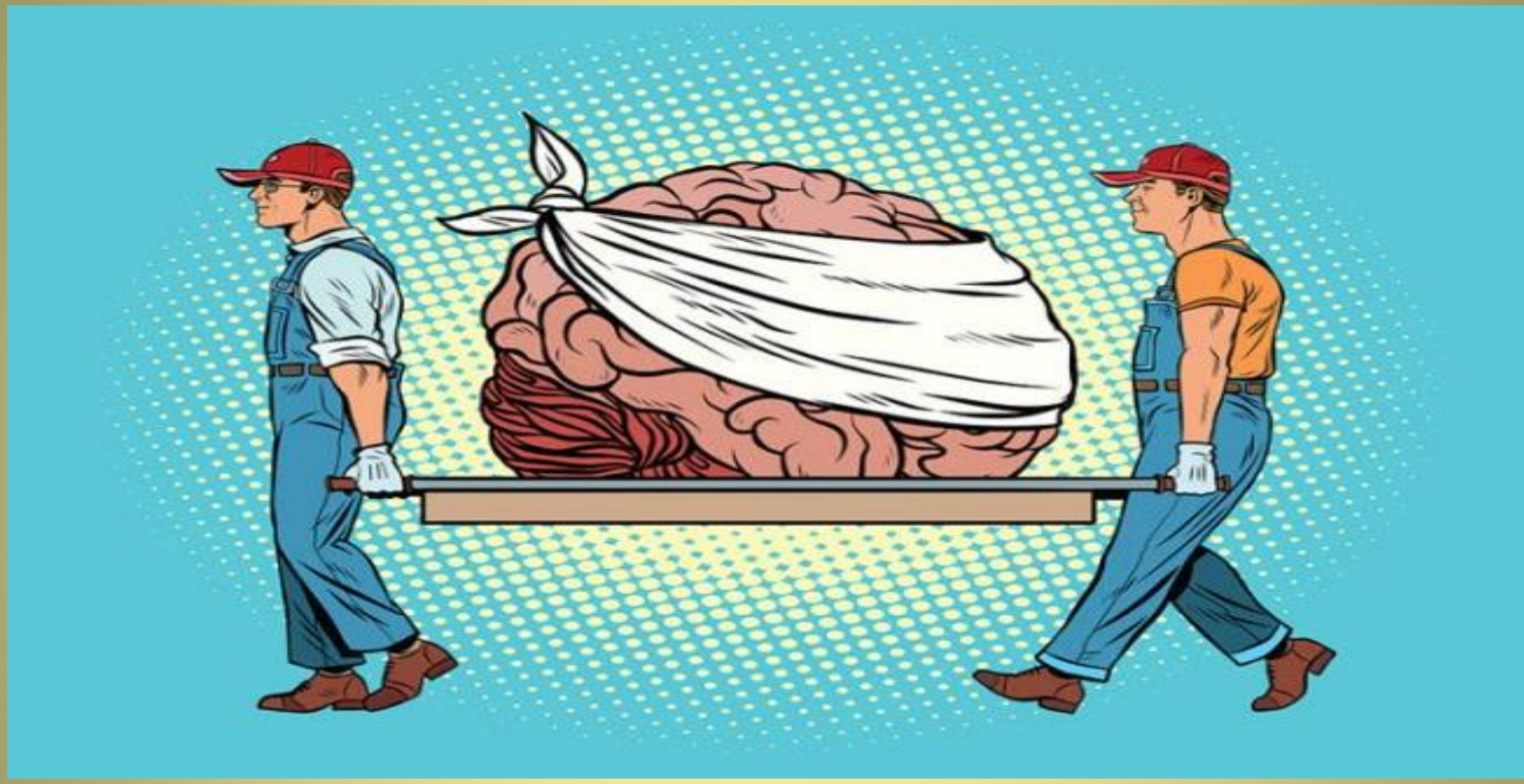
TRAUMATIC BRAIN INJURY – TBI

NEURO-PSYCHIATRIC ASSESSMENT

Dr VTR Ntsanwisi





DEFINITION

A traumatically induced structural injury or physiological disruption of brain function, as a result of external force, that is indicated by at least one of the following clinical signs, immediately following the event:-

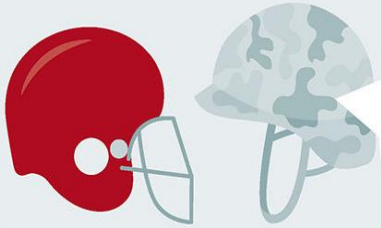
- Any period of **Loss of Consciousness**
- Any **Loss of Memory** (Retrograde or Anterograde amnesia)
- Confusion, Disorientation and Diminished Cognitive Speed - **Alteration of Consciousness**
- **Neurological Deficits** (Weakness, Loss of Balance, Change in vision, Praxis, Paresis/Paraplegia, Sensory Loss, Aphasia)
- **Intracranial Lesion**

For the Primer, visit doi:10.1038/nrdp.2016.84

Traumatic brain injuries (TBIs) are a major cause of disability and death worldwide. Clinically subdivided into mild, moderate and severe forms, mild TBI (also known as concussion) accounts for 80–90% of cases. Insights from severe TBI and chronic traumatic encephalopathy (CTE) can probably shed light on the underlying cellular and molecular processes involved in mild TBI.

EPIDEMIOLOGY

Approximately 10 million TBIs occur each year worldwide. The most common causes are falls and road traffic accidents, which account for >50% of cases. Contact sports athletes and military service personnel are unique, increasingly studied risk groups for TBIs; the incidence of sports-related TBI visits to emergency rooms is 152 cases per 100,000 individuals in the United States.



Several studies suggest a relationship between repetitive TBI and CTE, a neurodegenerative condition characterized by perivascular tau deposition, axonal damage and variable amounts of astroglial scarring and Aβ plaques

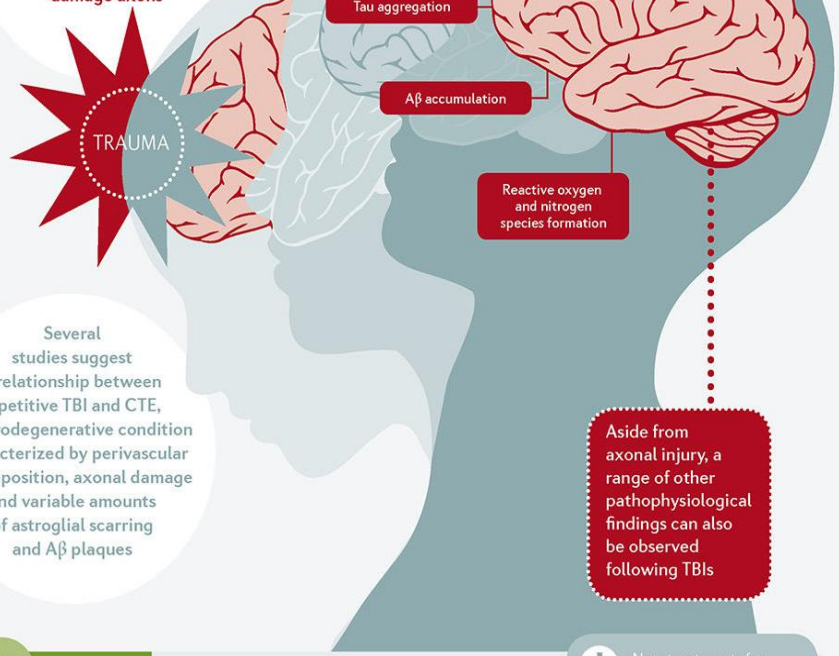
QUALITY OF LIFE

Levels of cognitive and physical disability in patients with TBI depend on the severity of injury, and can affect mood, fatigue and social participation. 12 months after mild TBI, patients have a similar quality of life to controls, but this can decrease over time, owing to a loss of life roles and the development of depression.

MECHANISMS

Brain damage in TBIs is caused by rotational and/or linear acceleration forces, or blunt trauma with impact deceleration, which generate forces that stretch and damage axons

Axonal injury is considered a key mechanism of damage following TBIs, as the severity of axonal injury correlates with the extent of disability



Aside from axonal injury, a range of other pathophysiological findings can also be observed following TBIs

OUTLOOK

More research is required to understand the number and/or severity of TBIs that initiate the neurodegeneration that underlies CTE. In addition, studies are needed to elucidate the precise role of tau aggregates and amyloid-β (Aβ) deposits in TBIs and CTE.

New treatments for TBIs include those that target cerebral oedema, prevent secondary tissue damage and promote neuroprotection or neuroregeneration.

DIAGNOSIS

TBIs are classified based on several clinical factors, including the Glasgow Coma Scale score, results of radiographic imaging (CT or MRI) and the presence of neurological symptoms and amnesia. Newer radiographic imaging techniques, such as diffusion tensor imaging, can be used to detect axonal injury in patients with TBI. PET ligands that bind to Aβ plaques and tau can be used to monitor the deposition of these molecules in the brain and could be used to assess the pathology of TBIs.

Biomarkers are emerging to assess the severity of brain damage, predict prognosis and guide clinical management. Candidates include markers of neuronal damage, immune response and astrocyte function.

MANAGEMENT

At the scene of injury or in the emergency room, patients have a brief interview and a neurological examination. If indicated, patients can undergo radiographic imaging. The standard of care for patients with TBI is rest, observation for 24 hours and verbal and written instructions for identifying the possible complications of TBIs.

Few guidelines for the diagnosis or management of athletes with potential CTE are available. However, many clinicians would advise an athlete to retire from sports after sustaining multiple concussions.

Written by Louise Adams; designed by Laura Marshall

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FACTORS determining Neuropsychiatric Manifestations

1. Personality and Temperament before injury

1. Family Psychiatric Hx

1. Previous Psychiatric, Medical and Neurological Hx

1. Psychosocial, Economic and Vocational status

FACTORS determining Neuropsychiatric Manifestations…

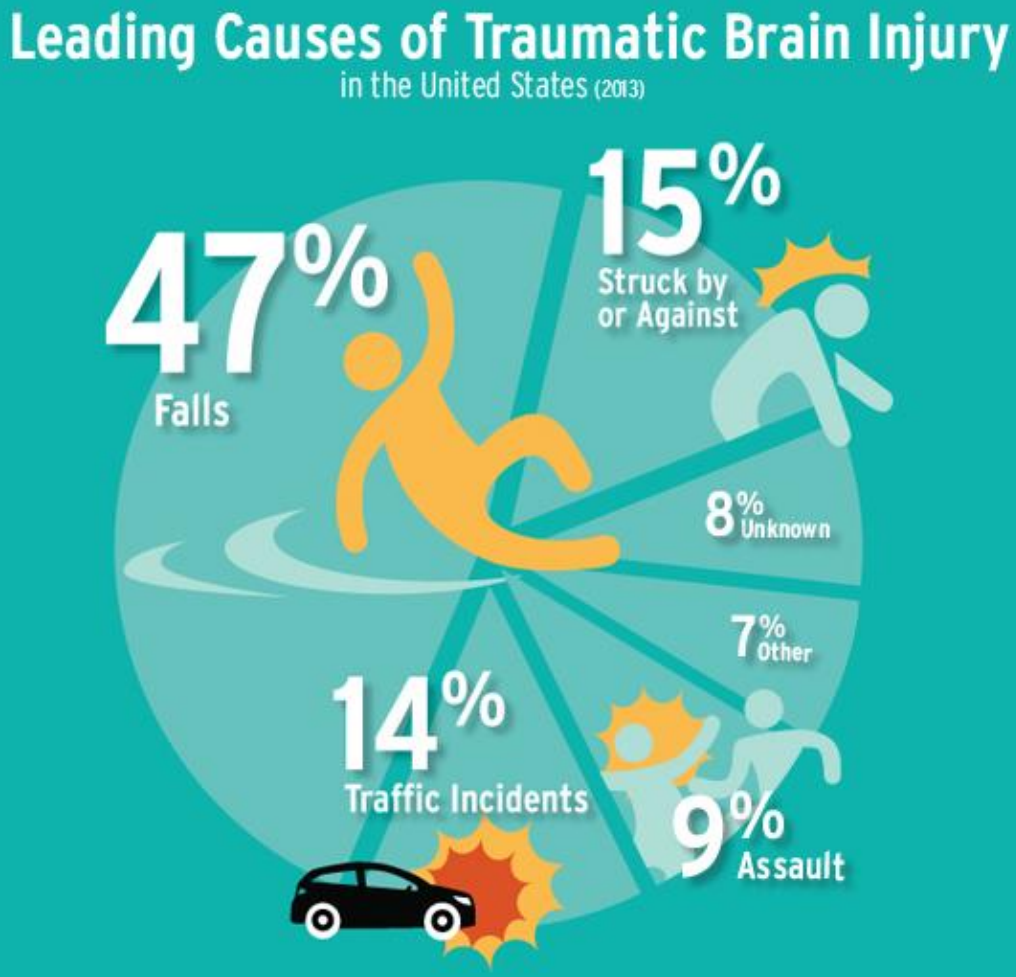
5. Type, Location and Severity of brain injury

6. Emotional and Psychological response

6. Impact on Personal and Professional roles and relationships

8. Interplay between impairments and community Barriers and Supports

CAUSES

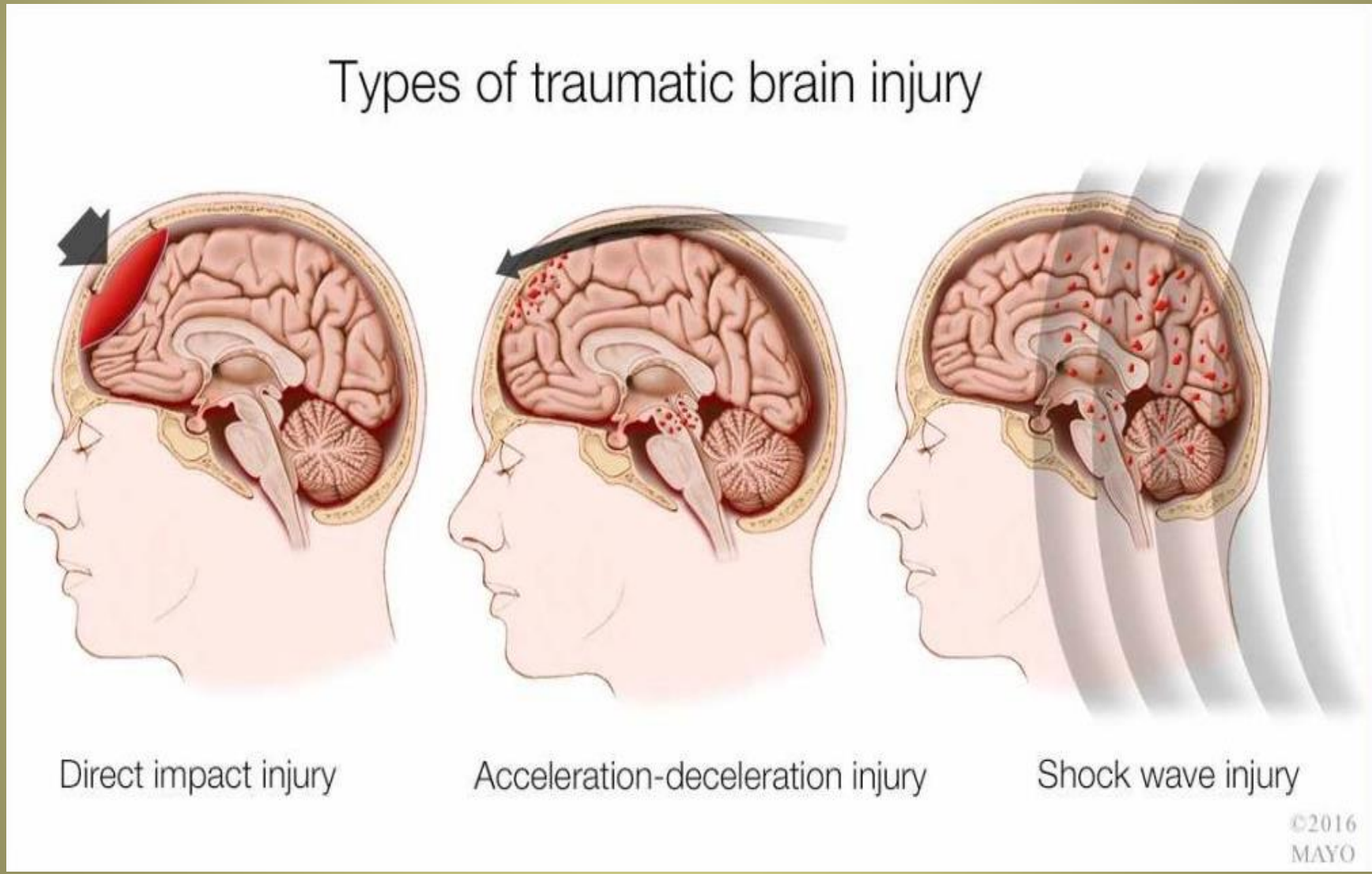

Leading Causes of Traumatic Brain Injury
in the United States (2013)
47%
Falls
15%
Struck by or Against
8%
Unknown
7%
Other
14%
Traffic Incidents
9%
Assault

CAUSES…Sport Injuries

CAUSES…Warfare

CAUSES…MVA

TYPES of TBI


Types of traumatic brain injury
Direct impact injury
Acceleration-deceleration injury
Shock wave injury
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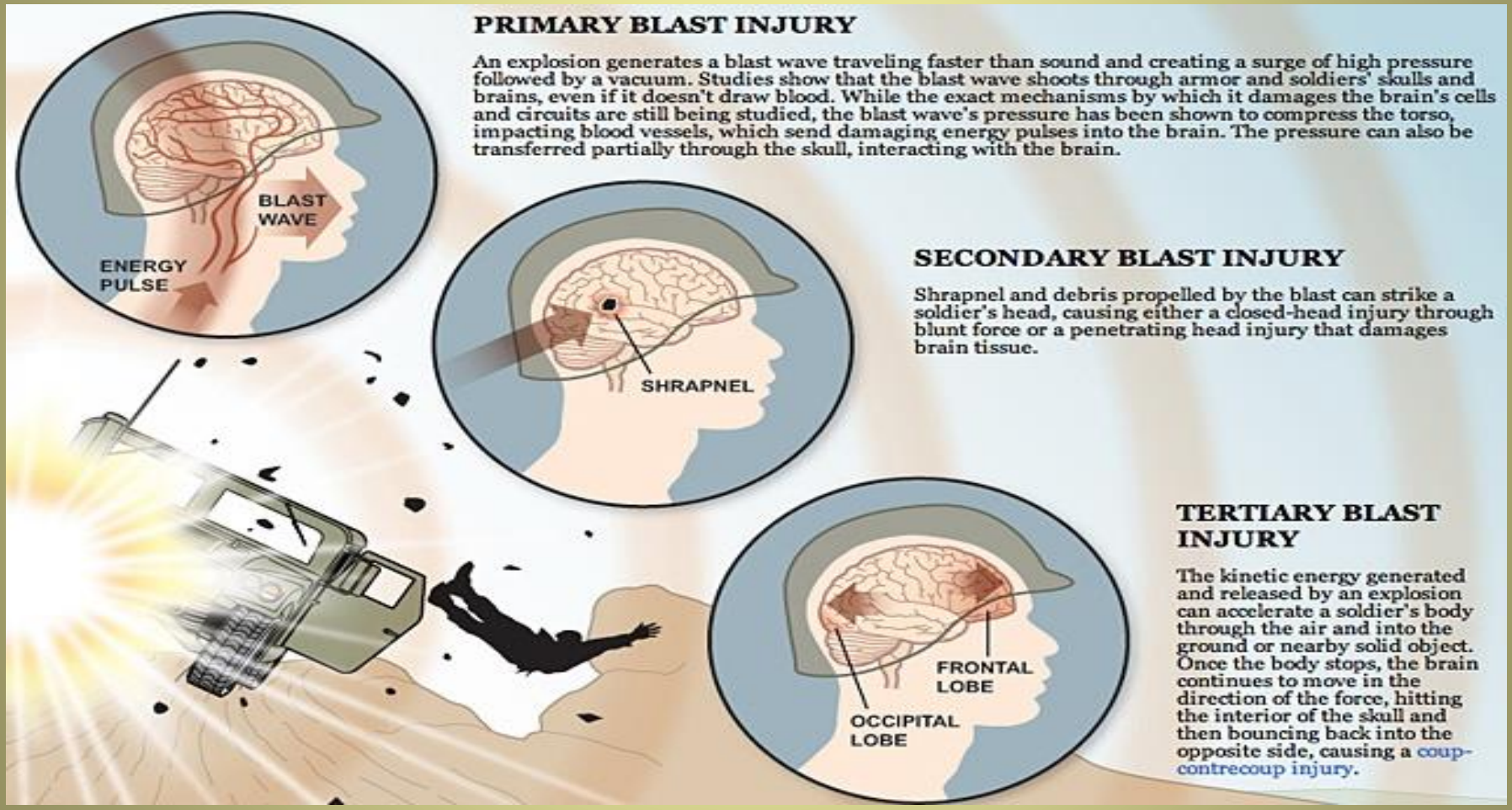
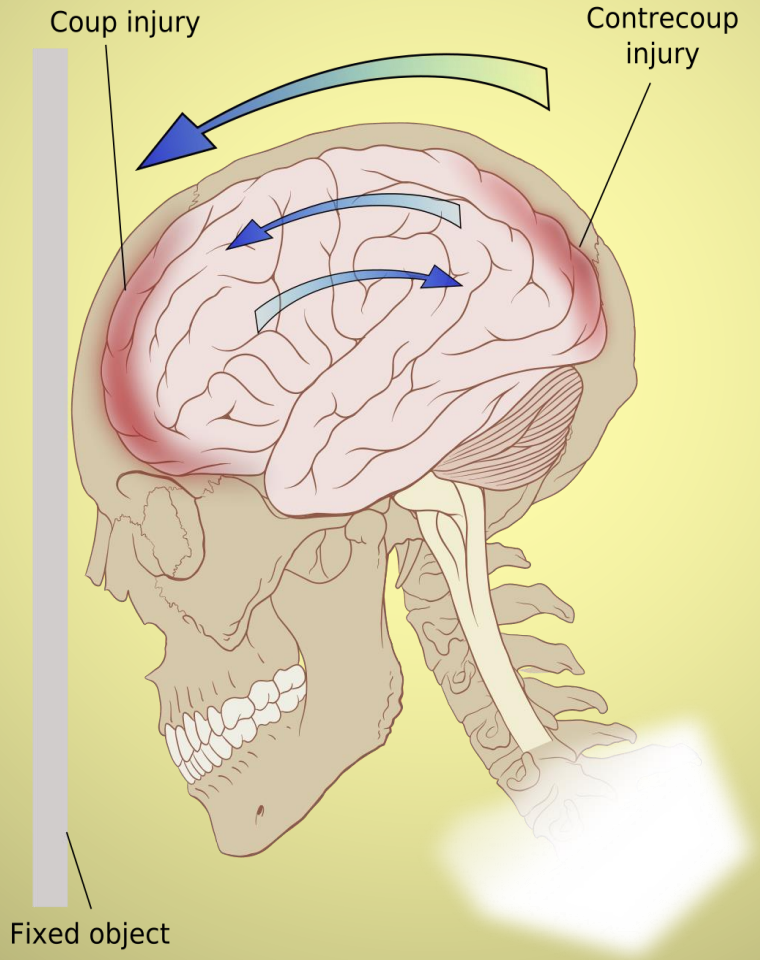
MAYO

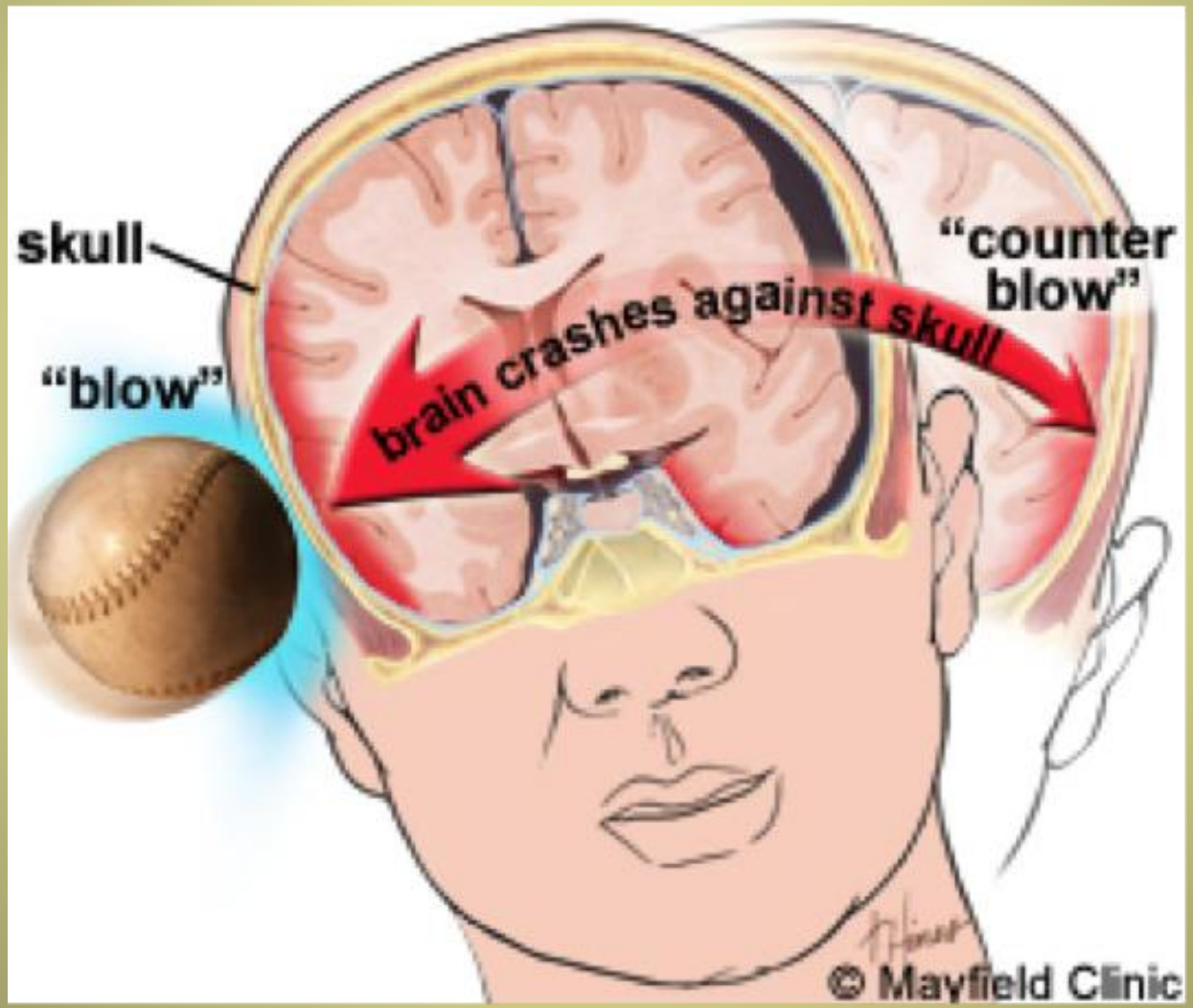
TYPES of BLAST INJURIES



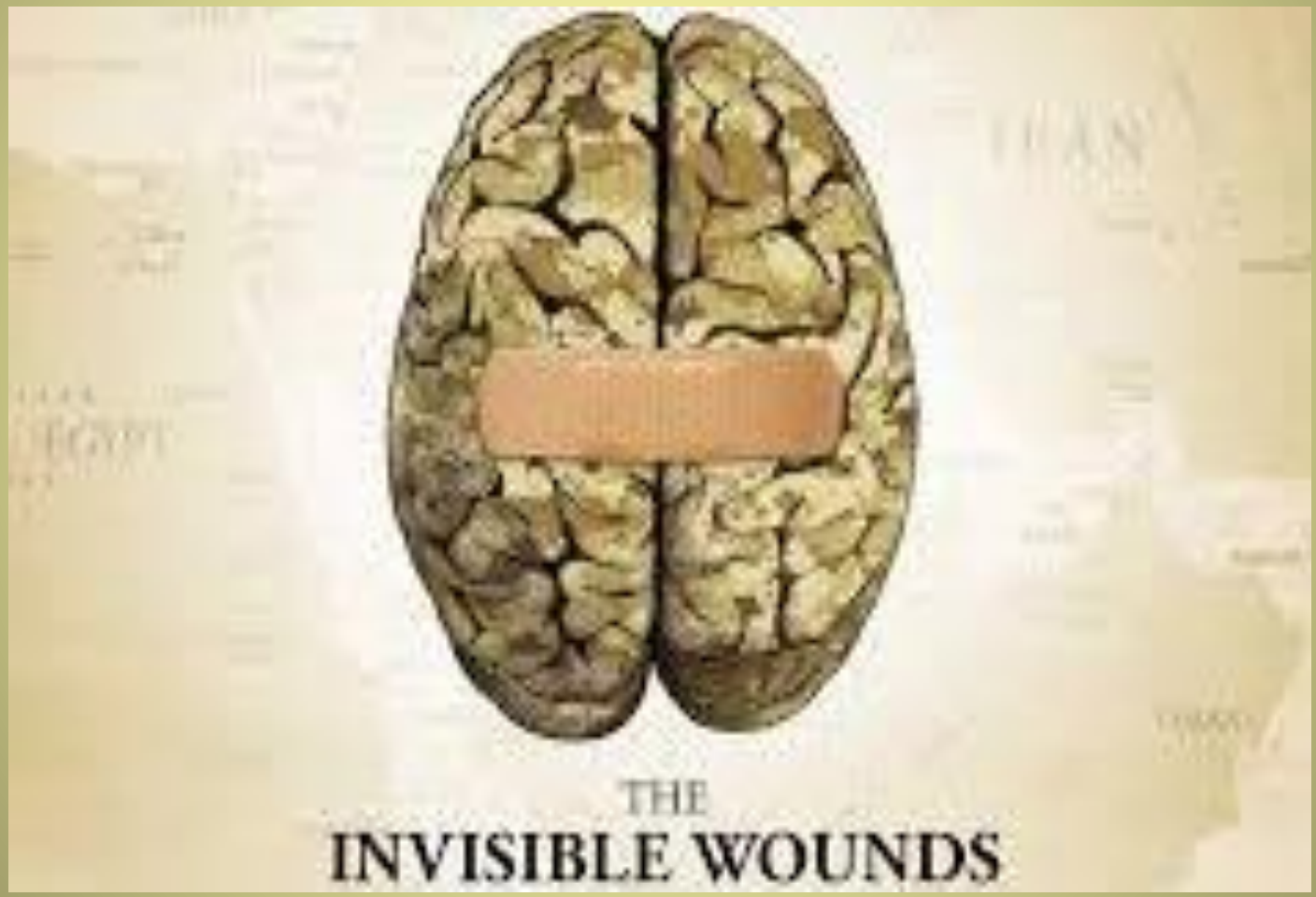
COUP – CONTRECOUP INJURY : 1



COUP – CONTRECOUP INJURY : 2



HIDDEN INJURIES



TBI – Hidden in 3 aspects:-

- Difficulty in detecting Diffused Axonal Injury
- Effects of TBI not obviously physical
- TBI may elude both examiner and patient (Invisible Injury)

CLASSIFICATION of TBI

MILD	MODERATE	SEVERE
Primary Damage/Injury Mechanism: Predominantly blast, non-penetrating	Primary Damage/Injury Mechanism: Frequently mixed, Blast + Acceleration/Deceleration, Typically non-penetrating	Primary Damage/Injury Mechanism: Complex, Blast + Acceleration/Deceleration + Penetration
Loss/Alteration of consciousness: < 30 minutes	Loss/Alteration of consciousness: > 30 minutes, < 24 Hours	Loss/Alteration of consciousness: > 24 Hours
Amnesia: < 24 Hours	Amnesia: > 24 Hours, < 7 Days	Amnesia: > 7 Days
GCS: 13 - 15	GCS: 9 - 12	GCS: < 9
Imaging: Negative	Imaging: Transient changes	Imaging: Positive, Lasting abnormalities
Co-Morbidity: PTSD, overlapping symptoms	Co-Morbidity: PTSD, other injuries	Co-Morbidity: Polytrauma, such as multiple organ injuries
Outcome: Transient Neuropsychiatric deficits, mostly full recovery. Long-term Neuropsychiatric especially after repeated injuries are frequent	Outcome: Mild to moderate, Typically chronic, neurological and neuropsychiatric abnormalities	Outcome: Death, Significant Neurological and Neuropsychiatric deficits. Severe, Chronic physical and Neuropsychiatric disabilities

Mayo -
TBI Severity Classification System

CRITERIA A:

Classify as **Moderate-Severe** (**definite**) **TBI** if one or more of the following criteria apply:

1. Death due to this TBI
2. Loss of consciousness of 30 minutes or more
3. Post-traumatic anterograde amnesia of 24 hours or more
4. Worst GCS full score in first 24 hours < 13 (unless invalidated upon review, eg. attributable to intoxication, sedation, systemic shock [**confounders**])

Mayo -

TBI Severity Classification System…

5. One or more of the following present: (**Criteria A…**)

- Intracerebral haematoma
- Subdural haematoma
- Epidural haematoma
- Cerebral contusion
- Haemorrhagic contusion
- Penetrating TBI (dura penetrated)
- Subarachnoid haemorrhage
- Brainstem injury

Mayo -

TBI Severity Classification System…

CRITERIA B:

If none of Criteria A apply, classify as **Mild** (**probable**) **TBI** if one or more of the following criteria apply:

1. LOC of momentary to less than 30 minutes
2. Post-traumatic anterograde amnesia of momentary to less than 24 hours
3. Depressed, basilar, or linear skull fracture (dura intact)

Mayo -

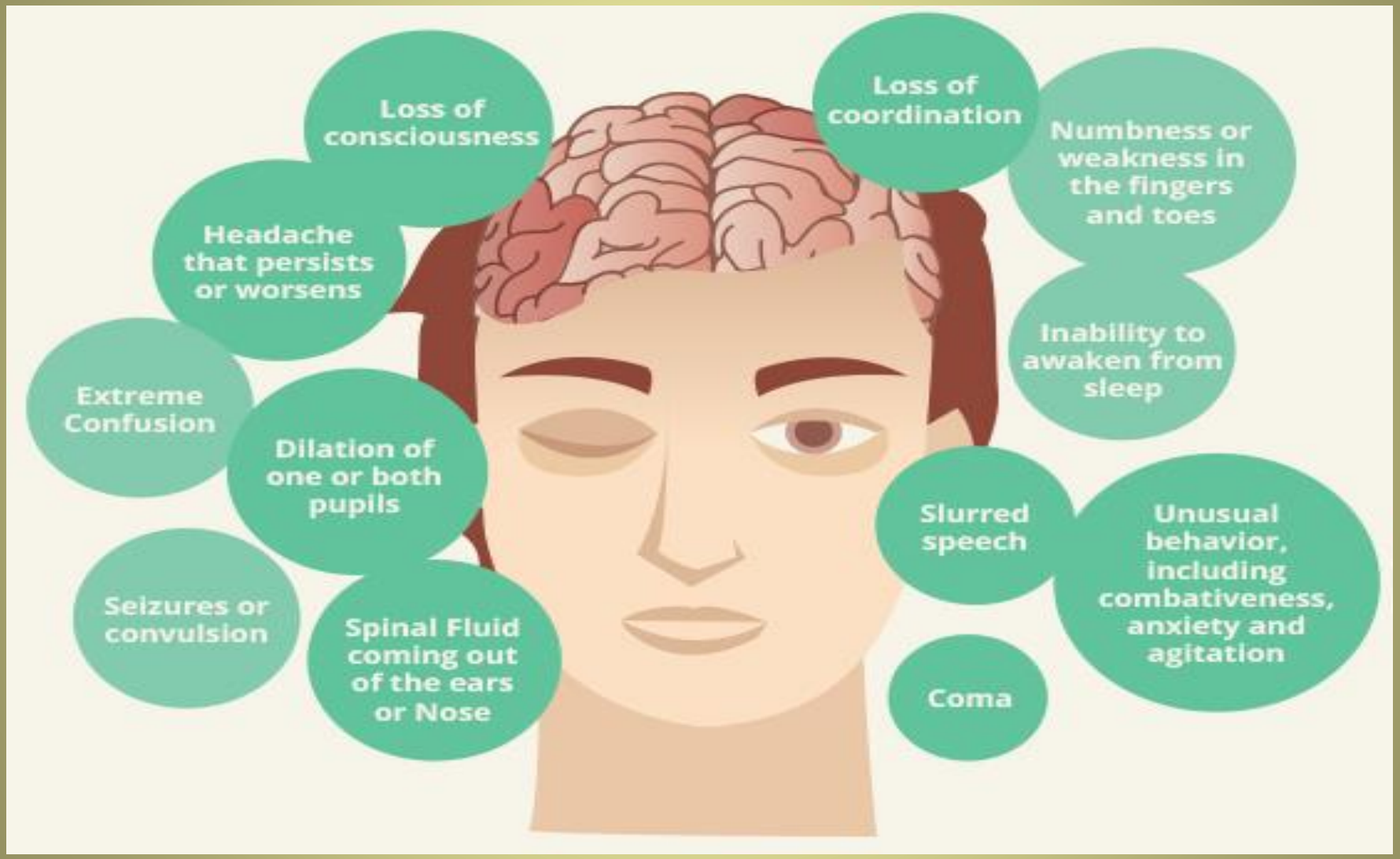
TBI Severity Classification System…

CRITERIA C:

If none of Criteria A or B apply, classify as **Symptomatic** (**possible**) **TBI**, if one or more of the following symptoms are present:

- Blurred Vision
- Confusion (Mental state changes)
- Dazed
- Dizziness
- Focal neurologic symptoms
- Headache
- Nausea

SYMPTOMS OF TBI



TBI SYMPTOM CHECKLIST

COGNITIVE	EMOTIONAL	BEHAVIOURAL	PHYSICAL
▪ LOC	○ Mood swings / Lability	▪ Impulsivity	○ Fatigue
			○ Weight Change
▪ Sensorium	○ Depression	▪ Disinhibition	○ Sleep Disturbances
			○ Headache
▪ Attention/Concentration	○ Hypomania/Mania	▪ Anger dyscontrol	○ Visual Problems
			○ Balance Difficulties
▪ Short-term memory	○ Anxiety	▪ Inappropriate sexual behaviour	○ Dizziness
			○ Coldness
▪ Processing Speed	○ Anger/Irritability	▪ Lack of initiative	○ Change in Hair/skin
			○ Seizures
▪ Executive Function	○ Apathy	▪ Change in personality	○ Spasticity
			○ Loss of urinary control
▪ Thought Processes			○ Arthritic complaints

CONFOUNDERS of GCS, duration of LOC & PTA

- Intoxication
- Hypovolaemic Shock
- Sedation
- Intubation
- Facial Injuries

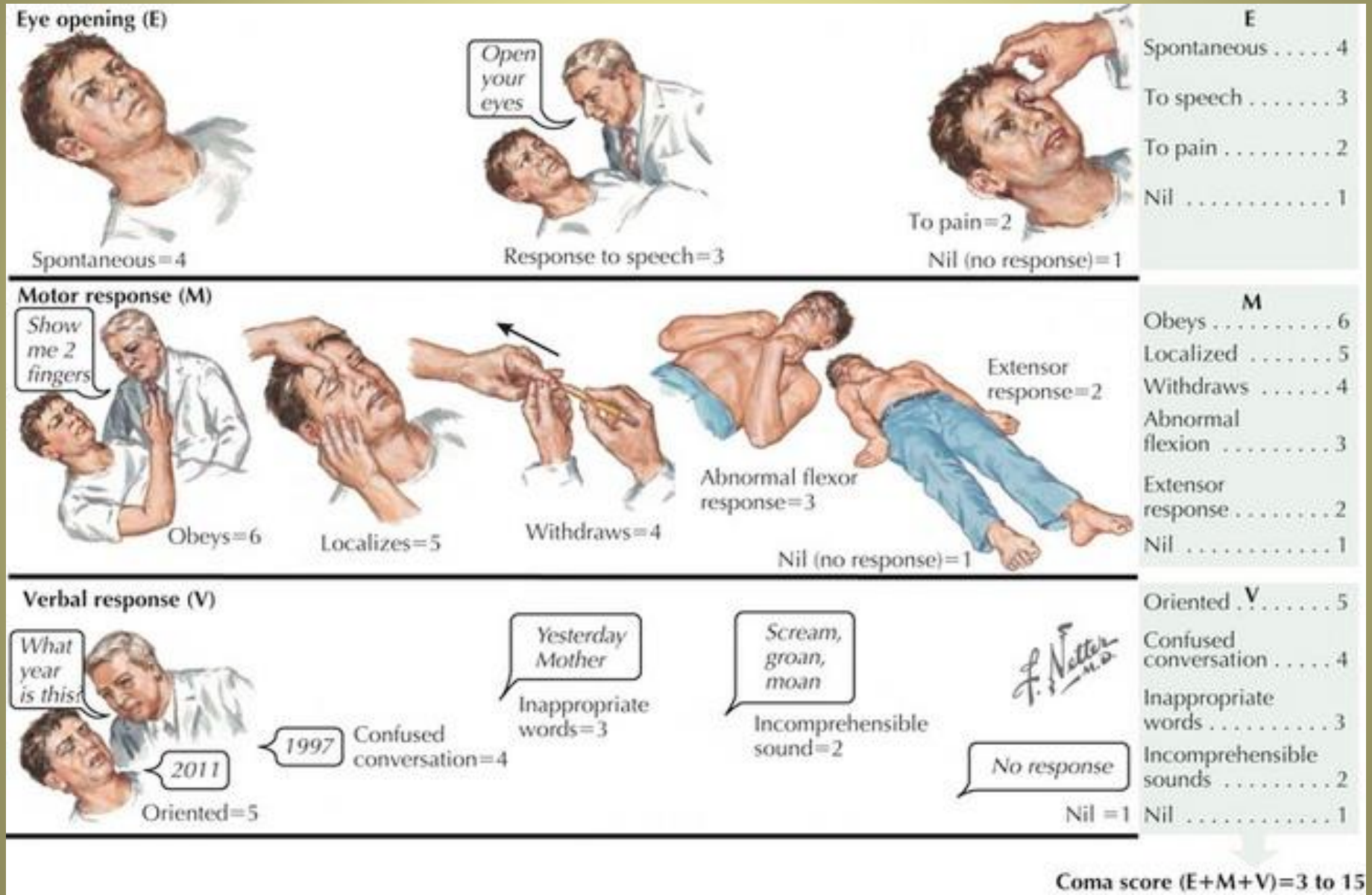
SAMPLE QUESTIONS for TBI ASSESSMENT

Questions	Rationale
▪ Have you ever hit your head	○ Probe for car, motor cycle, bicycle/ other MVAs, Falls, Assaults, Sport or Recreational injuries, Blast injuries
▪ Have you ever been in an accident	
▪ Have you been in or near an explosion	
▪ (If so) Did you black out, pass out or lose consciousness	○ Establish LOC (verify LOC with witness, if possible)
▪ What is the last thing you remember before the injury	○ Establish extent of Retrograde Amnesia
▪ What is the first thing you recall after the injury	○ Estimate duration of LOC and/or PTA (must ask when contiguous memory function returned to define PTA interval)
▪ (If no known LOC) At the time of the injury, did you experience any change in your thinking or feel “dazed” or “confused”	○ Establish change in mentation or LOC

SAMPLE QUESTIONS for TBI ASSESSMENT…

Questions	Rationale
▪ Did you suffer any other injuries during the incident?	○ Identify related injuries that may contribute to symptoms presentation
▪ What problems did you have after the injury?	○ Delineate post-TBI symptoms
▪ Has anyone told you that you are different after the injury? If so, how have you changed?	○ Detect problems outside survivor's awareness or those he/she may be minimizing
▪ Did anyone witness or observe your injury?	○ Identify source of collateral history
▪ Many people who have injured their head have been drinking or using drugs, how about you?	○ Offer survivor great "permission" to admit substance use and determine if substances contributed to the altered mental status at the time of injury
▪ Have you had any other injuries to your head or brain?	○ Identify previous TBIs that may increase morbidity from current injury

ASSESSMENT TOOL - GCS



ASSESSMENT TOOL - Galveston Orientation and Amnesia Test (GOAT)

Patient's Last Name : _____

Patient's First Name/s : _____

Date of Birth : _____ Age: _____

Date of Injury : _____

Diagnosis : _____

Date of Test : _____

Sex : **M / F**

Day of the Week : **S M T W T F S**

Purpose

GOAT assesses the pt's current level of orientation and recall of events that occurred before and after the accident. Particularly useful for determining PTA within the Acute Hospital setting.

Instructions:

Error points are scored for incorrect answers and are entered in the two columns on the extreme right side of the test form.

Enter the total error points accrued for the ten (10) items in the lower right-hand corner of the test form.

The GOAT score equals 100 minus the total error points.

ASSESSMENT TOOL - GOAT…

No.	Question	Notes	Error Score	Points
1.	What is your name	Must give both name and surname	/2	
	When were you born	Must give day, month and year	/4	
	Where do you live	Town is sufficient	/4	
2.	Where are you now a. City	Must give actual town	/5	
	b. Building	Usually in hospital or rehab centre. Actual name necessary	/5	
3.	When were you admitted to hospital	Date	/5	
	How did you get here	Mode of transport	/5	
4.	What is the first event you can remember after the injury	Any plausible event is sufficient. Record answer	/5	
	Can you describe in detail the first event you can recall after the injury	Date, Time, Companions, etc	/5	
5.	What is the first event you can remember before the accident	Any plausible event is sufficient. Record answer	/5	
	Can you describe in detail the first event you can recall after the injury	Date, Time, Companions, etc	/5	

ASSESSMENT TOOL - GOAT…

No.	Question	Notes	Error Score	Points
6.	What time is it now?	1 point for each half hour error removed	/5	
7.	What day of the week is it?	1 point for each day error removed	/5	
8.	What day of the month is it? (ie the date)	1 point for each day error removed	/5	
9.	What is the month?	5 points for each month error removed	/15	
10.	What is the year?	10 points for each year error removed	/30	

RANCHOS LOS AMIGOS COGNITIVE SCALE

LEVEL	RESPONSE	BEHAVIOUR
I	**No Response**	**Unresponsive to any stimulus**
II	General Response	Limited, Inconsistent and non-purposeful responses, often to pain only
III	**Localized Response**	**Purposeful responses, may follow simple commands, may focus on presented object**
IV	Confused, Agitated	Heightened state of activity, Confusion and Disorientation, Aggressive behaviour, Unable to perform self-care, Unaware of present events, Agitation appears to be related to internal confusion
V	**Confused, Inappropriate, Non-agitated**	**Appears alert, Responds to commands, Distractible, Does not concentrate on task, Agitated responses to external stimuli, Verbally inappropriate, Does not learn new information**
VI	Confused Appropriate	Goal-directed behaviour, Needs cuing, Can relearn old skills such ac ADL, Severe memory problems, Some awareness of self and others
VII	**Automatic, Appropriate**	**Appears appropriately orientated, Frequently robot-like in daily routine, minimal or absent confusion, Shallow recall, Increased awareness of self, and interaction in environment, Lacks insight into condition, Decreased judgement and problem solving, Lacks realistic planning for future**
VIII	Purposeful, Appropriate	Alert and orientated, Recalls and integrates past events, Learns new activities and can continue without supervision, Independent in home and living skills, Capable of driving, Defects in stress tolerance, Judgement and abstract reasoning persist, may function at reduced levels in society – p59

RANCHOS LOS AMIGOS COGNITIVE SCALE

LEVEL	RESPONSE	BEHAVIOUR
I - 1	No Response	**Total Assistance**: In deep coma, No response to any stimulus, ie visual, auditory, tactile, pain, etc, Coma state can last for seconds, minutes, hours, weeks, months
II - 2	General Response	**Total Assistance**: May have inconsistent and aimless physical movements largely due to pain, may open eyes to look blankly, unfocused
III - 3	Localized Response	**Total Assistance**: Begin to move eyes and lock in on people or objects. May respond to large sounds and noise. May follow simple commands: " Squeeze my hand"
IV - 4	Confused, Agitated	**Maximal Assistance**: Agitated and confused about present state and condition. Restless, Abusive, Aggressive, Bizarre behaviour. Could have incoherent conversation
V - 5	Confused, Inappropriate, Non-agitated	**Maximal Assistance**: More consistent with following simple commands. Memory is still impaired and damaged. Follows tasks better but easily distracted and tired. Needs a quiet and less "busy" environment
VI - 6	Confused Appropriate	**Moderate Assistance:** Increased awareness of family and staff. Recognition develops. More appropriate reactions and speech. Can easily follow simple instructions. Memory is still impaired
VII – 7	Automatic, Appropriate	**Minimal Assistance:** They begin to act appropriately. Seem to know who they are, where they are, the date and time. They can take care of daily routine tasks independently but with safety and supervision. Judgement and problem solving remain severely impaired
VIII - 8	Purposeful, Appropriate	**Standby Assistance:** Begins to remember the past, present and understand the future. Independent and functions appropriately in society. Difficulty with reasoning, judgement. Begins to learn a new way to live. Can be depressed, frustrated with the new life.
IX - 9	Purposeful, Appropriate	**Modified Independent:** Behaviour issues may develop. Has entered a new life, developing a routine, and normal way of life. A hopeful, happy future

ASSESSMENT TOOL - PTA SCALE

PTA SCORE	SEVERITY of INJURY
< 10 Minutes	Very Mild
10 – 60 Minutes	Mild
1 – 24 Hours	Moderate
1 – 7 days	Severe
> 7 Days	Very Severe

Length of PTA is the best indicator of the severity of the injury, it is a clinically useful predictor of outcome - (prognostic indicator of recovery from brain injury), and may correlate with psychiatric and behavioural sequelae


Thank
you


Time for Q&A

OUTLINE of PRESENTATION:

- What is **TBI** - (p3)
- What is **Neuropsychiatric Assessment**
- What are the **Risk Factors**
- What are the **Causes**
- What are the **Classification of TBI + MAYO** (p6 - **MMS**)
- What are the **Clinical Features**
- What is the **Symptoms Checklist of TBI**
- What are the **Confounders** of GCS, Duration of LOC + PTA
- What are the **Assessment Tools** used (p5 - Severity of brain injury)

  - **Sample Questions, GCS, GOAT, RANCHOS, PTA Scale**