



مستشفى الملك فيصل التخصصي ومركز الأبحاث
**King Faisal Specialist Hospital
and Research Centre**
Riyadh, Saudi Arabia



Traumatic Brain Injury

Ahmed Alkhani, MD, FRCSC, ABNS



Consultant Neurosurgeon
Dept. of Neurosciences
KFSH&RC
Associate Professor
Al-Faisal University



Traumatic Brain Injury

- 8% of all deaths in USA
- 200 per 100,000 /year
- 32,000 head injury/year in Saudi Arabia
- Mortality rate:
15-30 /100,000 /year
10,000/year in Saudi Arabia



Traumatic Brain Injury

4,800 Death

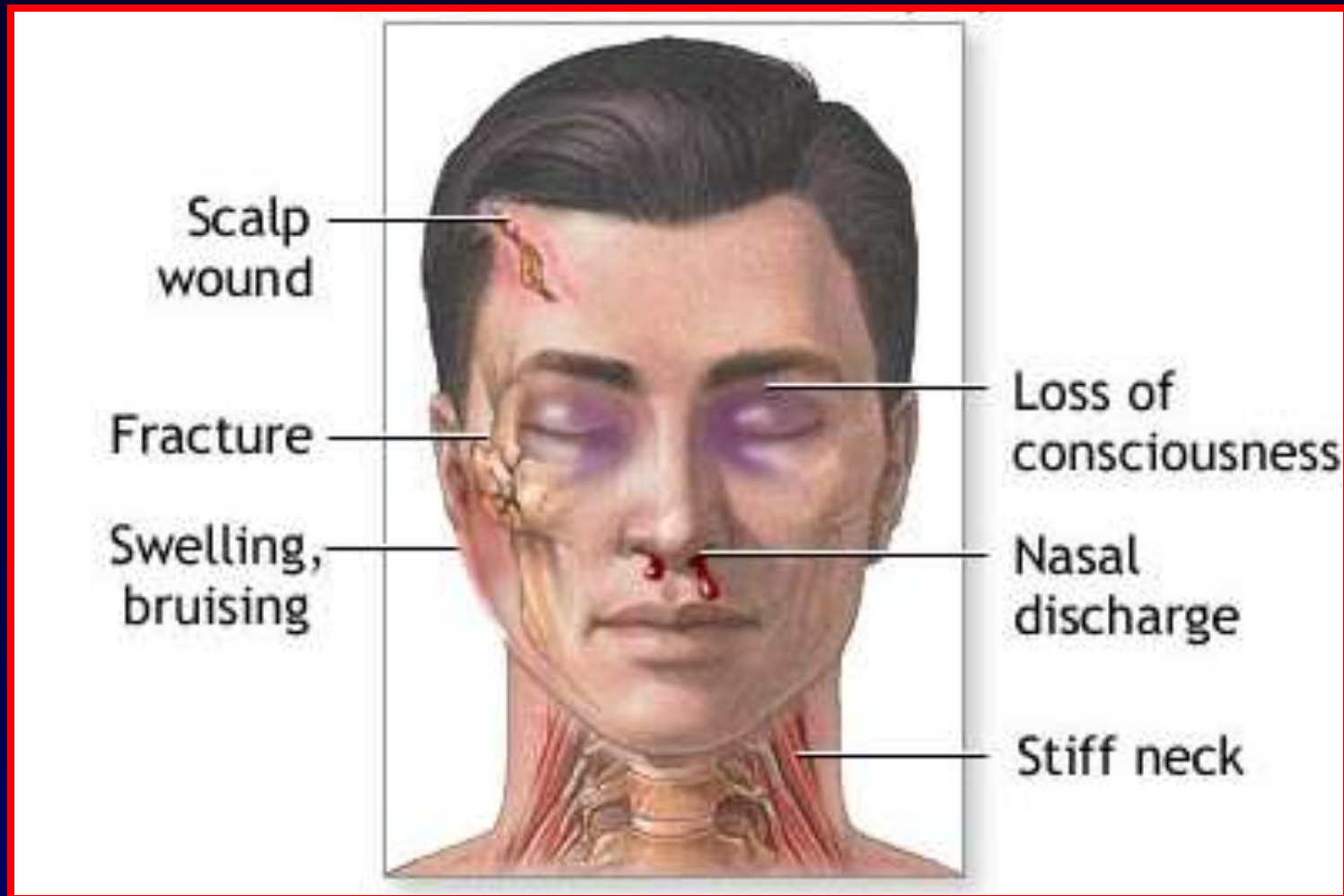
24,870 Hospitalized

131,600 medically attended

- Based on 1990 USA estimates. Corrected No. for Saudi Arabia based on a population of 24 M.

Traumatic Brain Injury

Scalp Lacerations:

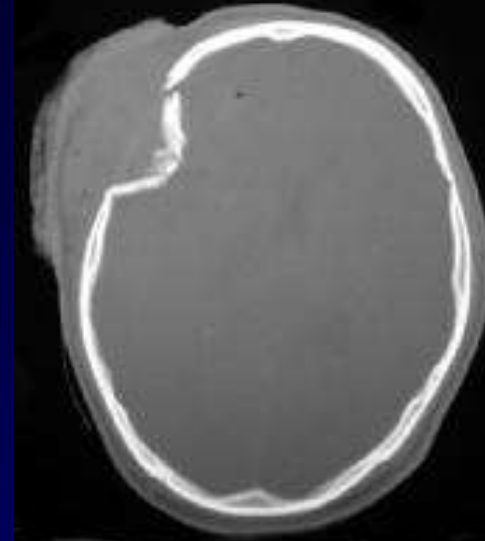


Traumatic Brain Injury

Skull Fractures:

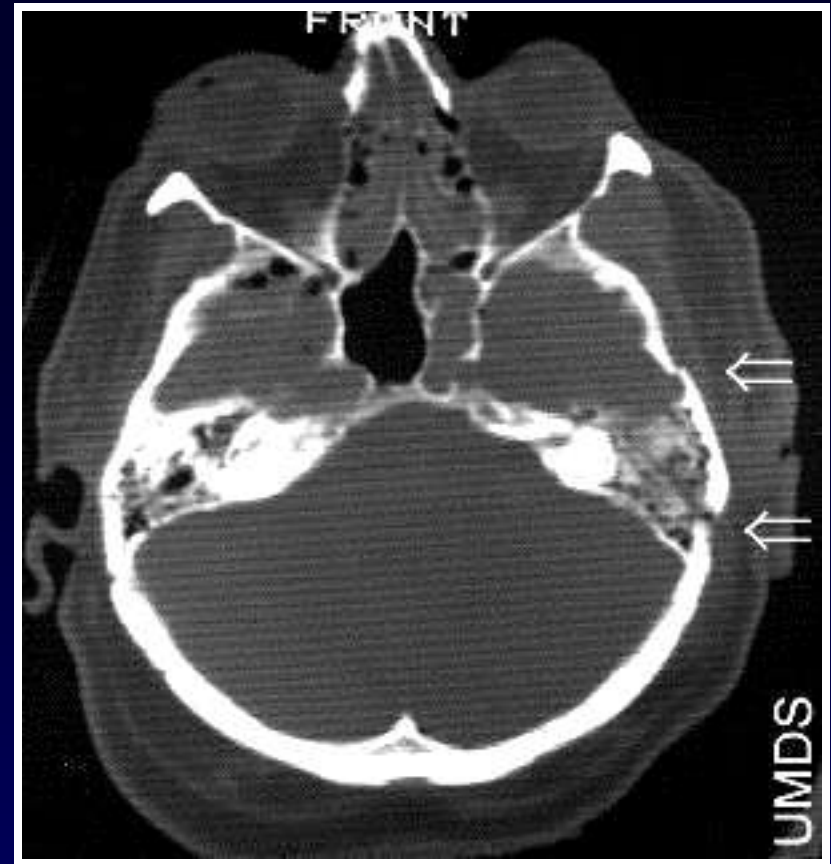
Indicate more severe injury

- 3% of medically attended TBI cases
- 65% of admitted & 80% of fatal TBI cases
- Depressed: fragments of inner tables of the skull are depressed by thickness of the diploe (11%)



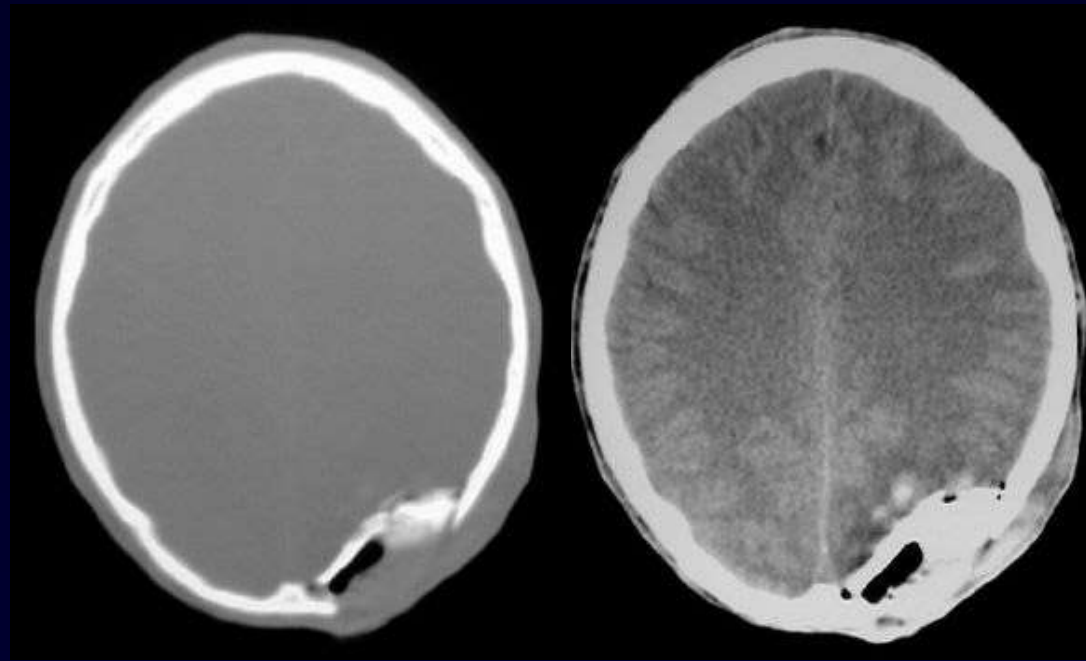
Traumatic Brain Injury

Skull Fractures:



Traumatic Brain Injury

Skull Fractures:



Compound: associated scalp laceration

Penetrating: if tearing in the dura

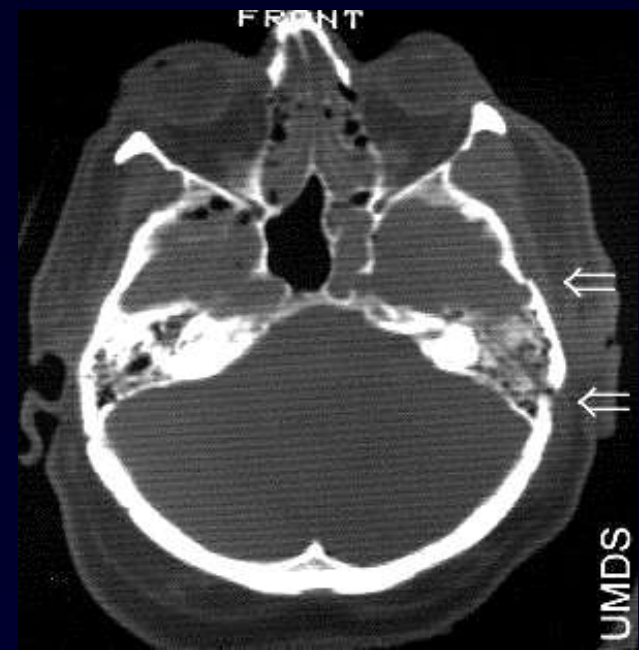
Both are potential routes for infection, post traumatic Epilepsy

Growing skull fracture

Traumatic Brain Injury

Skull Fractures:

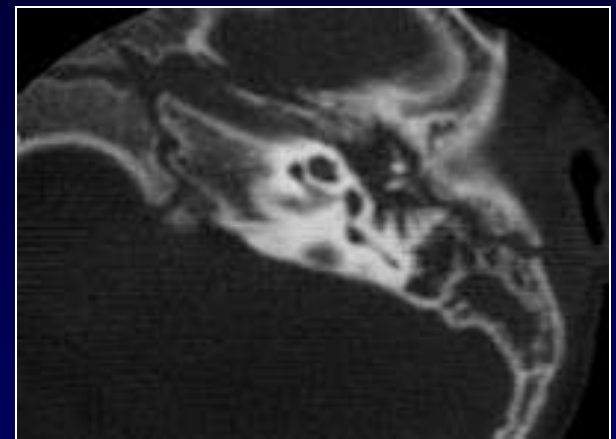
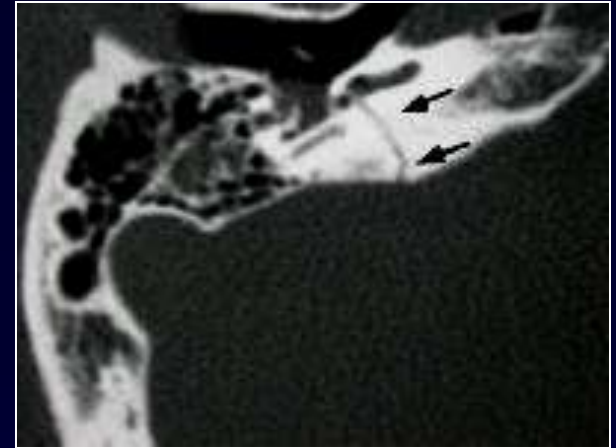
- Skull base fracture
- Infection
- CSF rhinorrhea
- Otorrhea
- Pneumocephalus



Traumatic Brain Injury

Cranial nerves injuries:

- Loss of sense of smell
- Orbital fractures; CNs 2,3,4 & 6
- Temporal # skull base: CNs VII & VIII



Traumatic Brain Injury

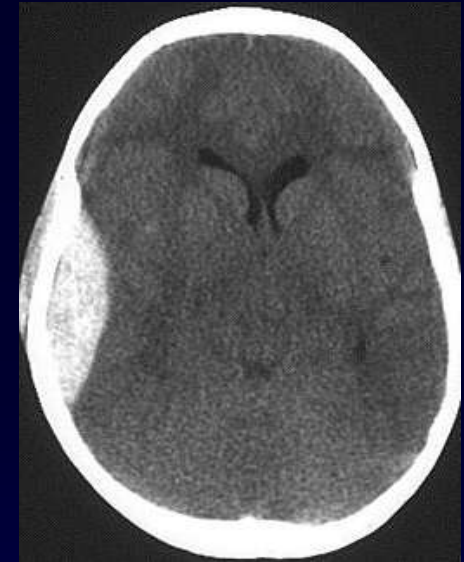
Extradural (Epidural) Hematoma:

- 2% of all types
- Concomitant # in 85% of patients
- 80% in the temporal area
- Torn meningeal blood vessels
- Younger age group
- Evacuation if $>30\text{mm}$ or $>15\text{mm}$ thickness

If not evacuated:

50% increased in 2 wks (liquification)

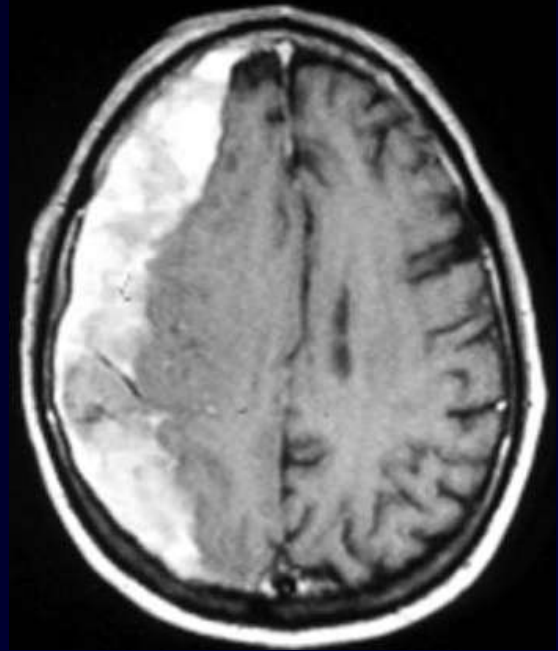
Get smaller & resolved in 4-6 wks



Traumatic Brain Injury

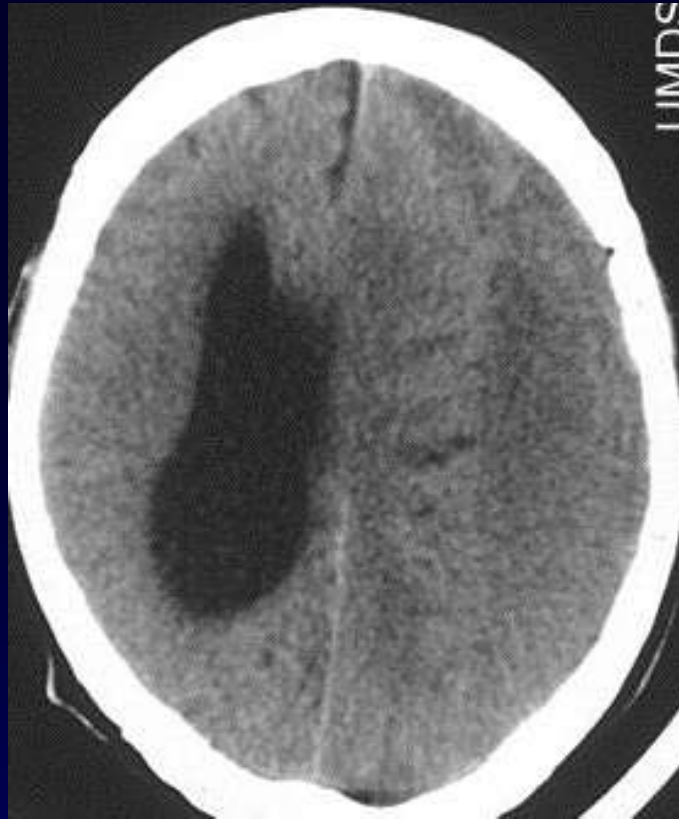
Subdural Hematoma:

- Rupture of bridging veins in the subdural spaces
- Significant associated cortical injury
- Evacuation if $>10\text{mm}$ or $>5\text{mm}$ shift
- Acute within 48hrs



Traumatic Brain Injury

Subdural Hematoma:



- Subacute in 2-14 days
- Chronic in >14 days

Traumatic Brain Injury

Intracerebral Hematoma:

- 16% of cases
- Often multiple
- Frontal and temporal lobes
- Rupture of intracerebral vessels
- Association with contusions
- Delayed appearance



Traumatic Brain Injury

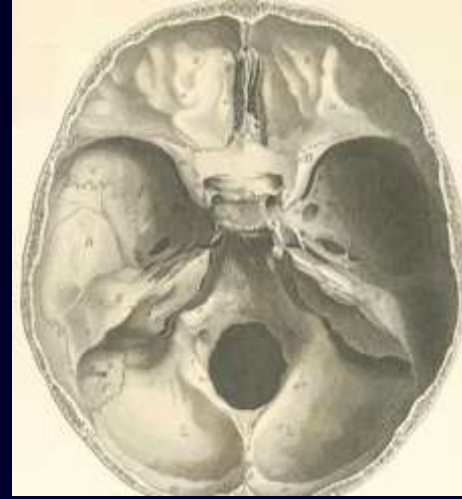
Subarachnoid Hemorrhage:

- Most common cause
- Severity of injury
- Vasospasm!



Traumatic Brain Injury

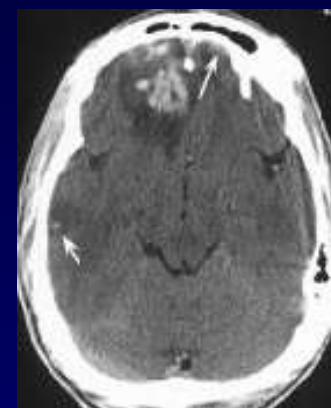
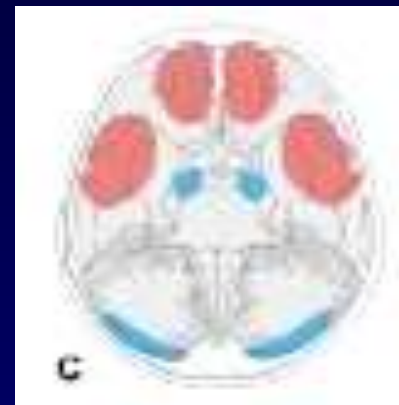
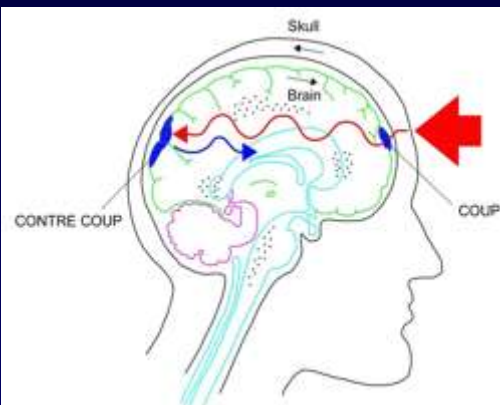
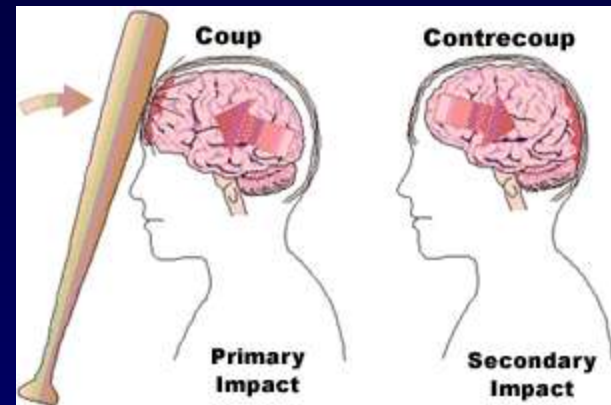
Brain Contusions:



Contusions: the contact between brain surface and the skull bony protuberances (Frontal, orbital, temporal area).

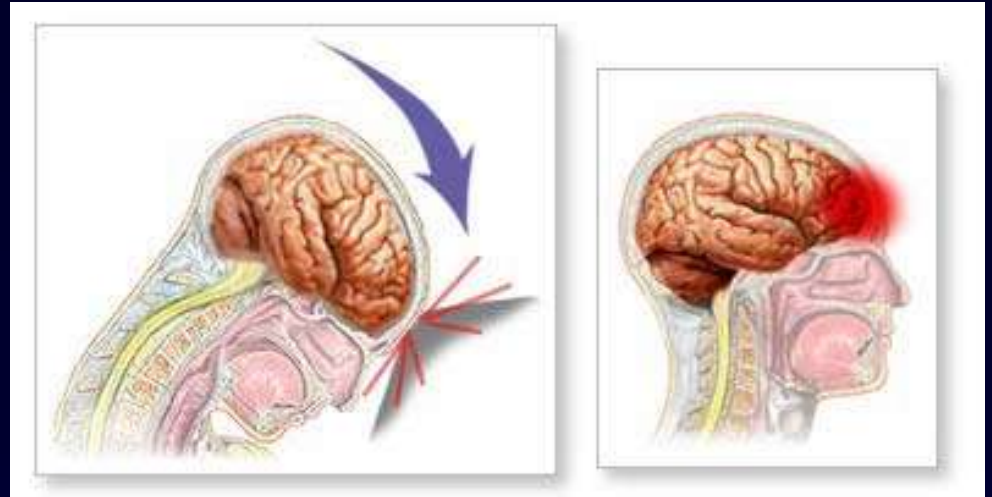
Coup: at the site of the injury

Counter-coup: diametrically opposite point of injury



Traumatic Brain Injury

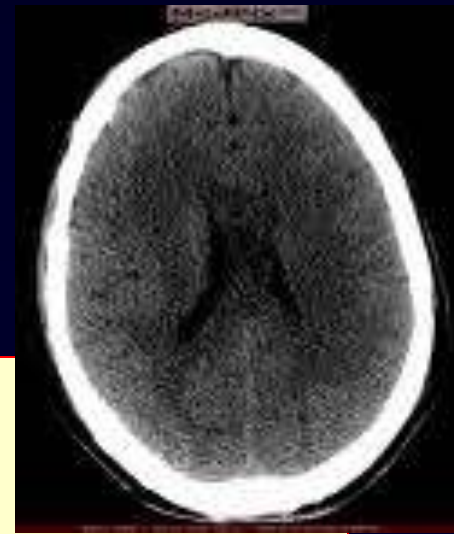
Concussions:



- Concussion of the deep structures of the brain
- Leading to widespread neurological dysfunction
- Impaired consciousness or coma.
- Concussion is a mild form of diffuse axonal injury.

Traumatic Brain Injury

Diffuse Axonal Injury:



- 50% of all severe head injury
- 35% of all deaths
- Vegetative state and severe disabilities
- Shearing injury of the axon leading to degeneration of white matter:
 - 1- lesions at corpus callosum, brain stem, cerebellar peduncles.
 - 2- wide spread shearing injury (Micro. damage to axons) axonal retraction balls

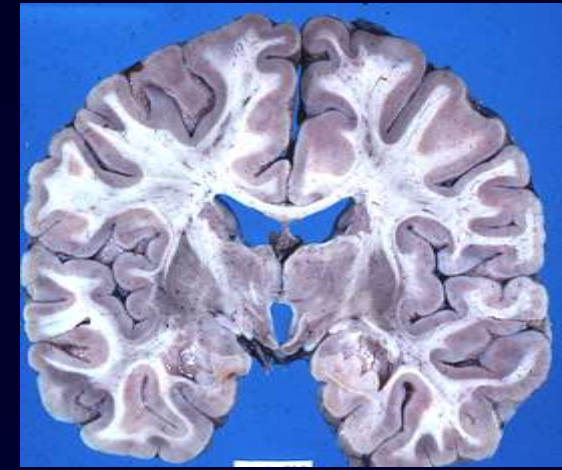
Traumatic Brain Injury

Diffuse Axonal Injury:

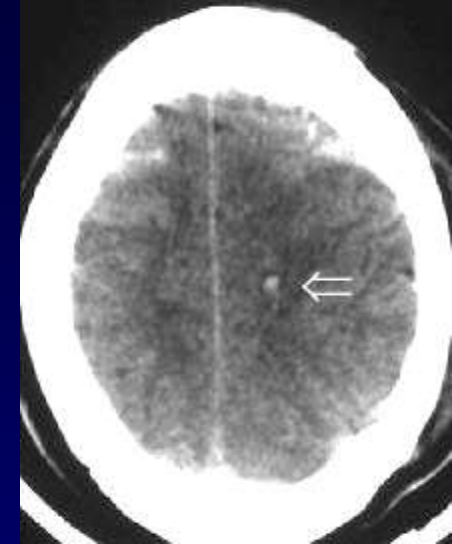
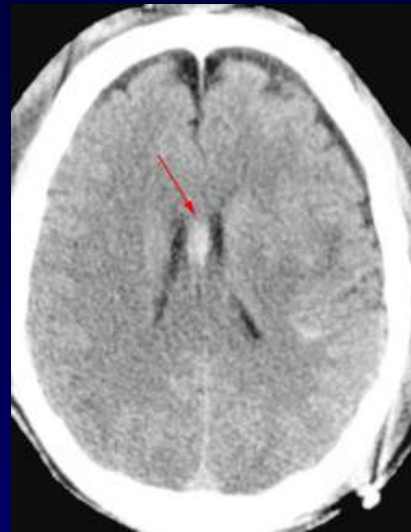
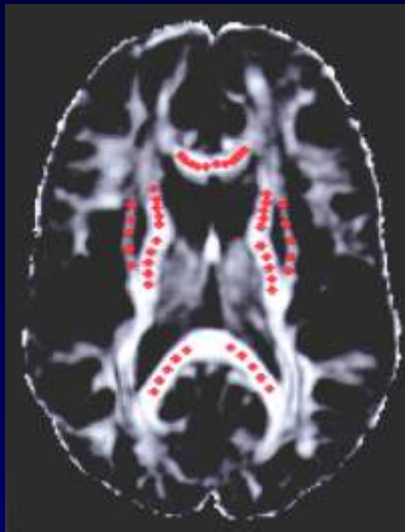
- 50% of all severe head injury
- 35% of all deaths
- Most common cause of vegetative state and severe disabilities
- Shearing injury that affects nerve fibers and leads to Degereration of white matter
 - 1- lesions at corpus callosum, brain stem, cerebellar peduncles.
 - 2- wide spread shearing injury (Micro. Damage to axons) axonal retraction balls

Traumatic Brain Injury

Diffuse Axonal Injury:



- Generalized white matter damage
- Strains of tentorium and falx during accel/deceleration
- Could occur as a result of ischemia.

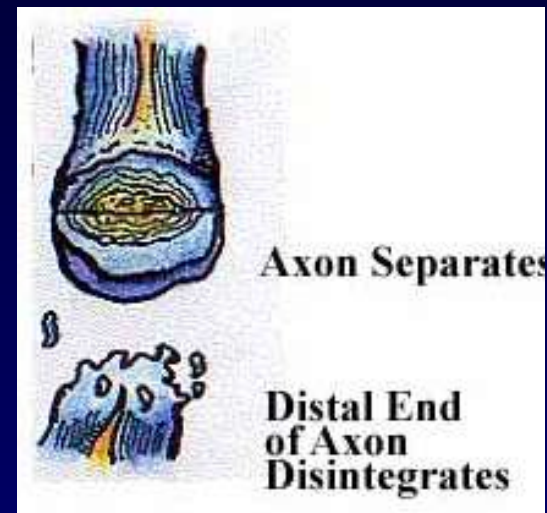
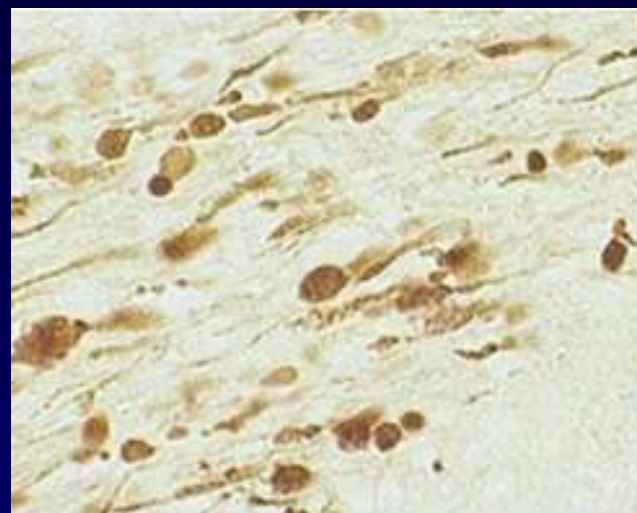
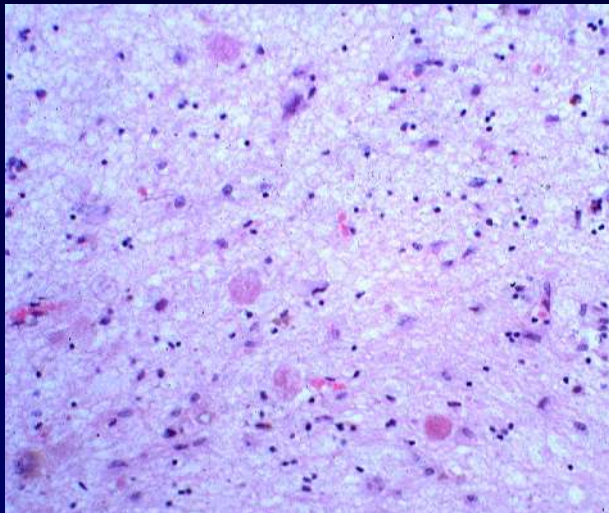


Traumatic Brain Injury

Diffuse Axonal Injury:

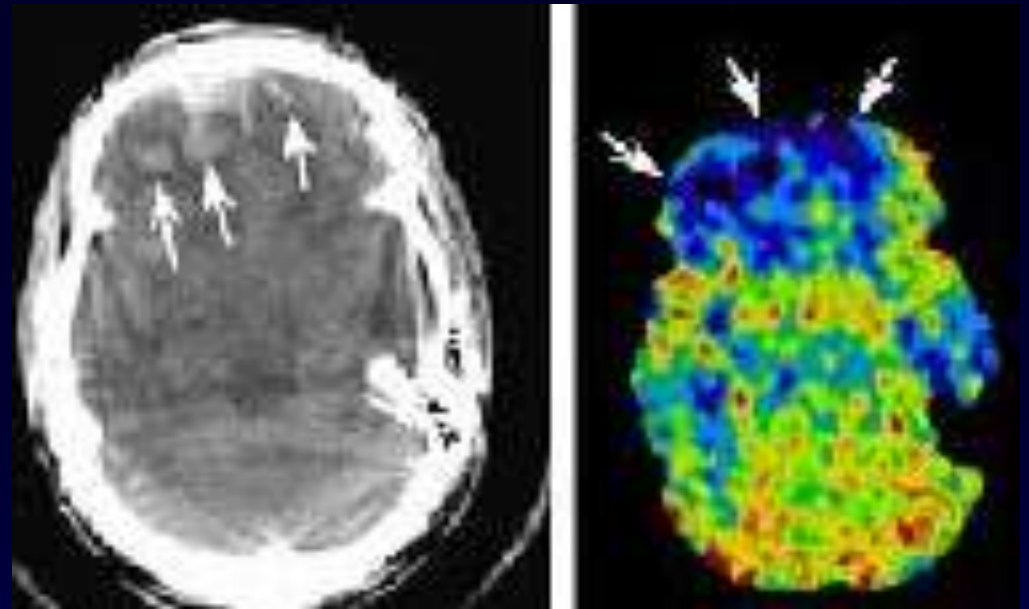
Shearing injury of the axon leading to degeneration of white matter:

- lesions at corpus callosum, brain stem, cerebellar peduncles.
- wide spread shearing injury (Micro. damage to axons)
axonal retraction balls



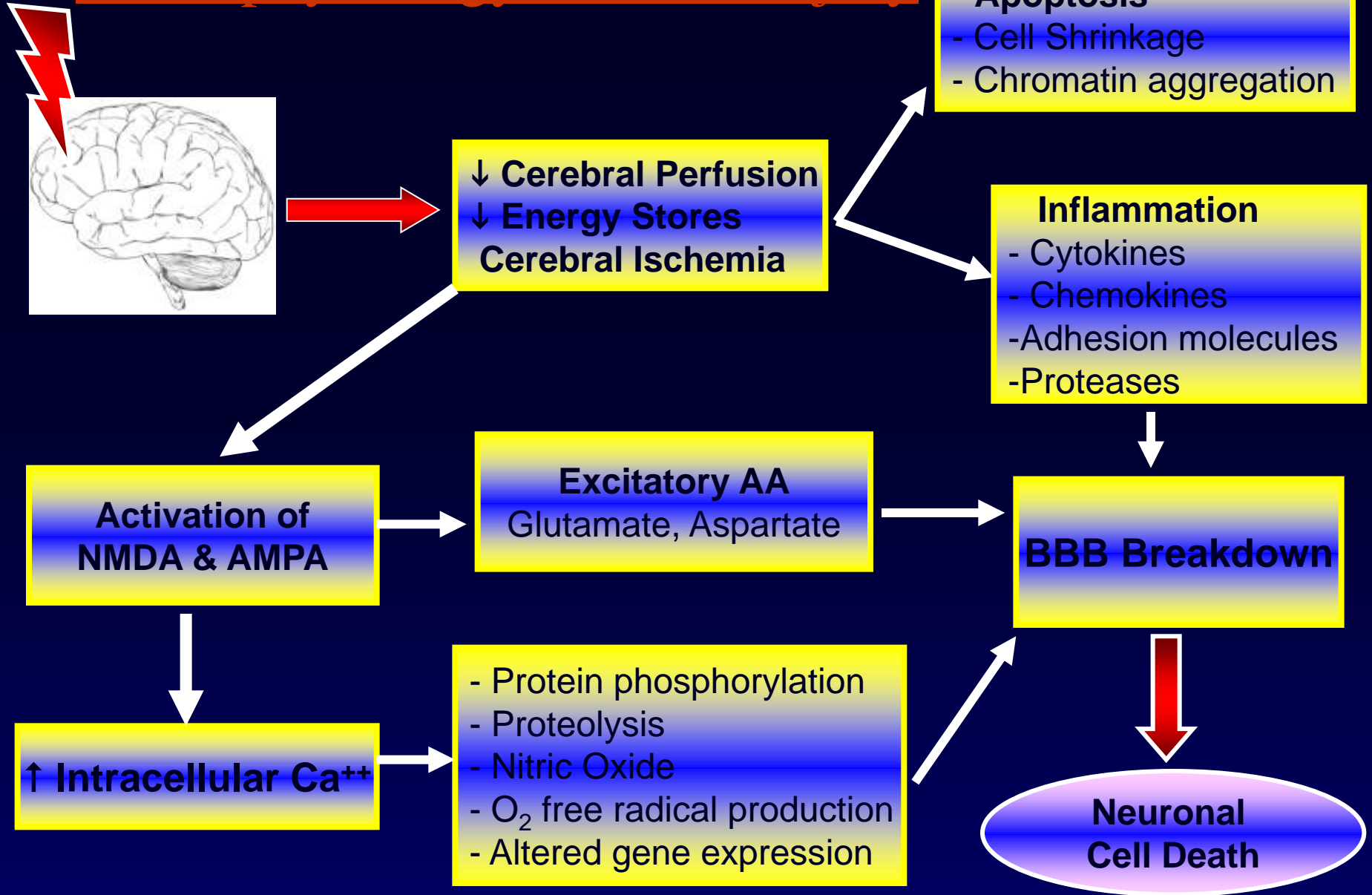
Traumatic Brain Injury

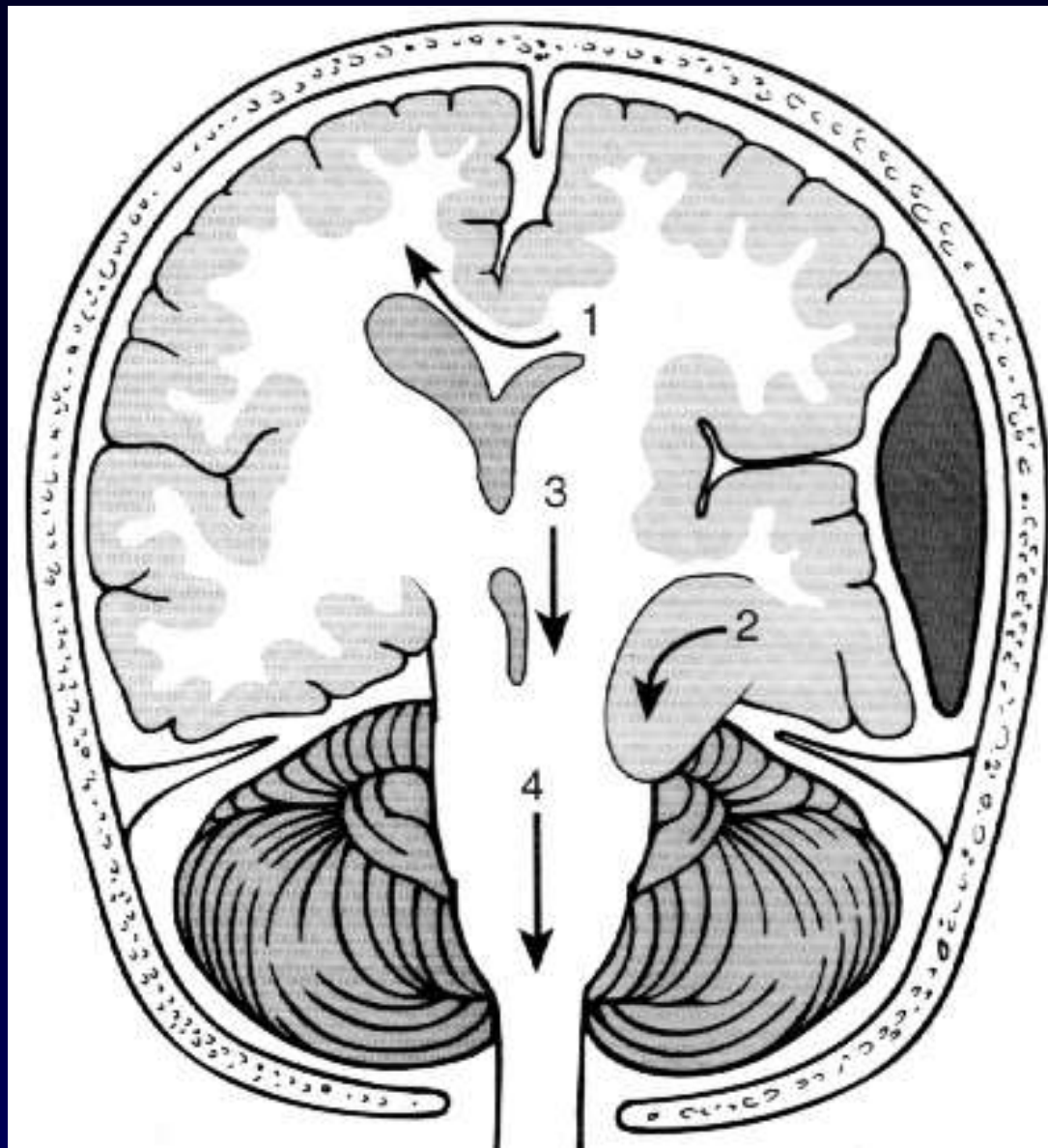
Ischemic brain damage:

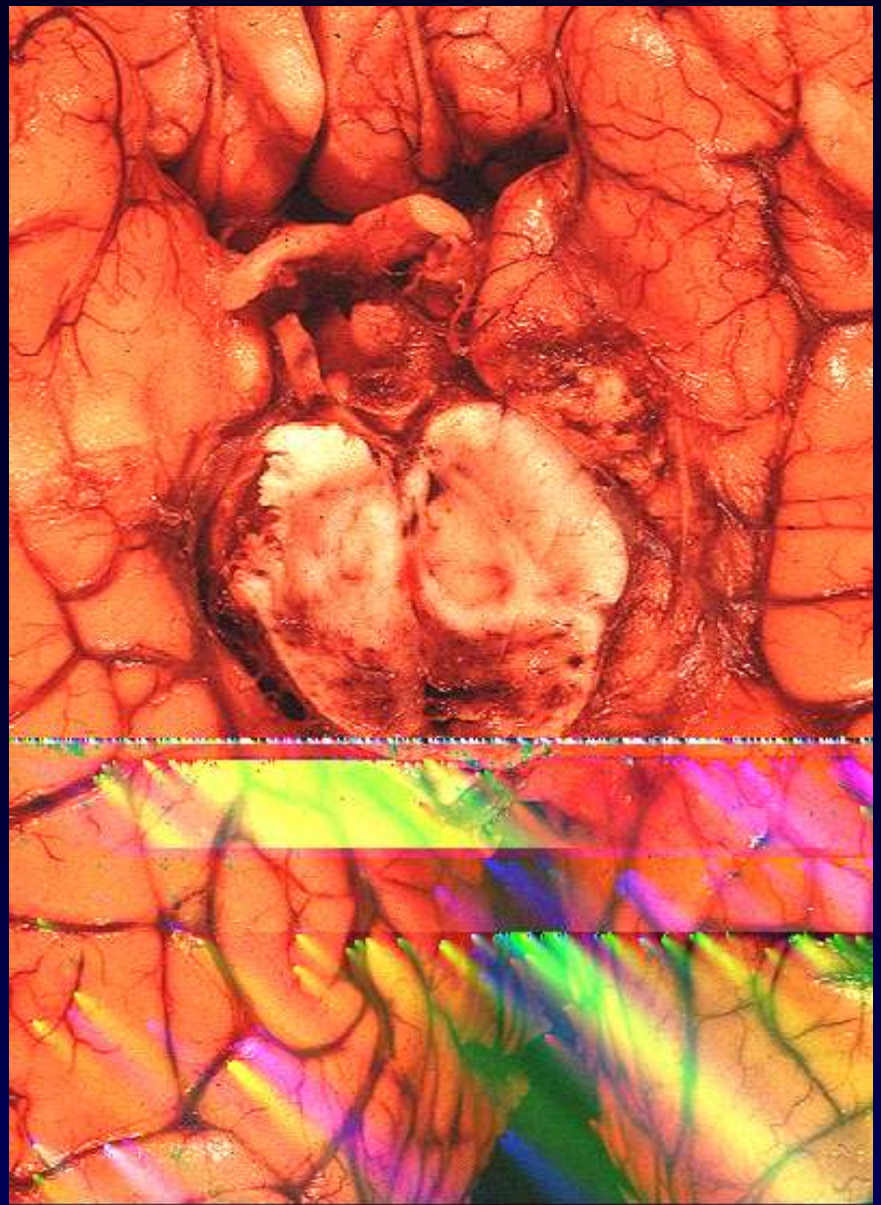


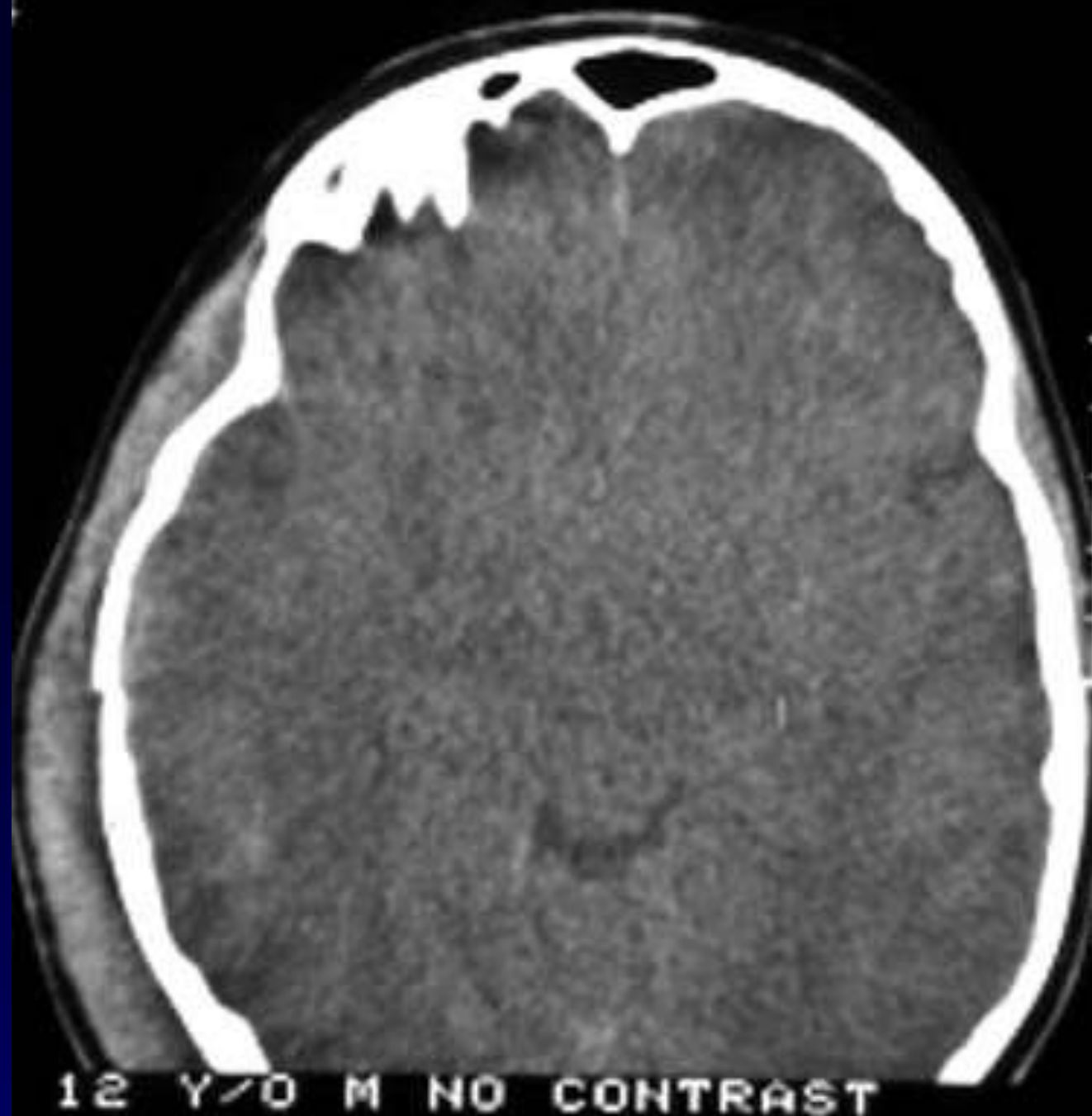
- much more common
- Occur soon after injury
- Hypoventilation, Hypo-perfusion
- Late with high ICP

Patho-physiology of Brain Injury









12 Y/O M NO CONTRAST

Traumatic Brain Injury Evaluation

ABC

Glasgow Coma Score

Traumatic Brain Injury

Transfer To a Neurosurgical Unit:

- By an anesthetist, even if not intubated.
- Physical disturbance during the journey.
- Ensure patient stability before transfer.
- Monitoring during the transfer.
- Formal handover to the neurosurgical team.
- A Copy of the CT scans.

Traumatic Brain Injury

Glasgow Coma Score

Glasgow Coma Score

Teasdale & Jennet Lancet 1974.

Used for:

- level of Consciousness
- Communication
- Management guideline
- Estimate prognosis

Glasgow Coma Scale for
Head Injury

Glasgow Coma Scale,

Eye opening

Spontaneous	4
To loud voice	3
To pain	2
None	1

Verbal response

Oriented	5
Confused, disoriented	4
Inappropriate words	3
Incomprehensible sounds	2
None	1

Best motor response

Obeys	6
Localizes	5
Withdraws (flexion)	4
Abnormal flexion posturing	3
Extension posturing	2
None	1

Traumatic Brain Injury

Management:

Mild head injury (GCS 14-15):

- admitted to a ward
- Frequent neurological observations
- Observed until complete neurological recovery
- Discharged if a responsible adult can supervise
- All patients with a GCS <15 should have a CT scan

Traumatic Brain Injury

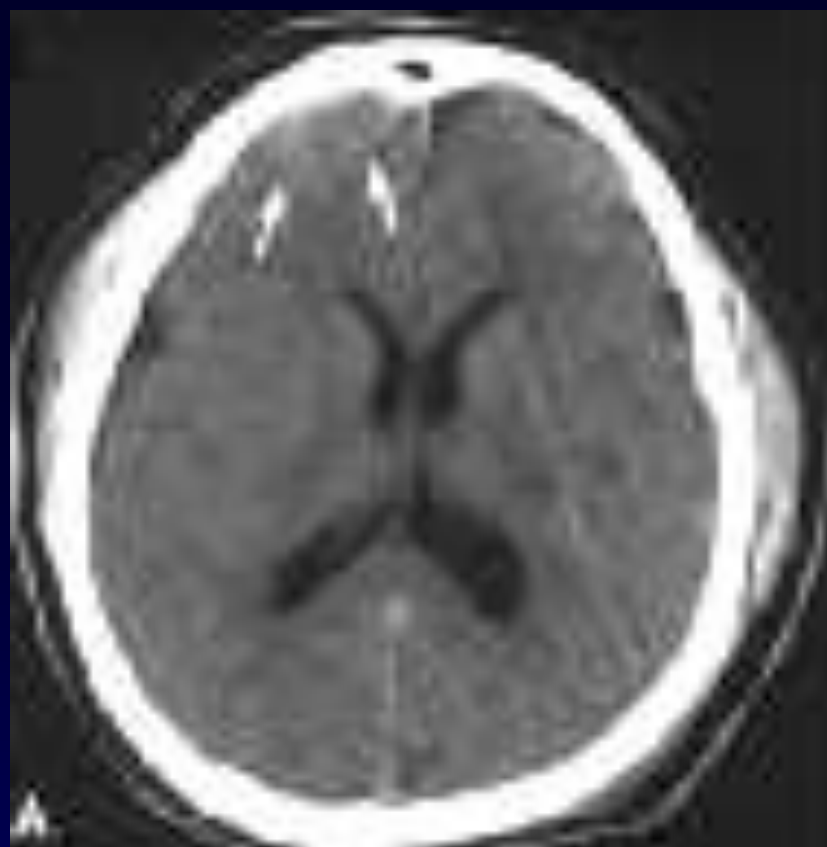
Monitoring:

NAME:

HOSPITAL NUMBER:

WARD:

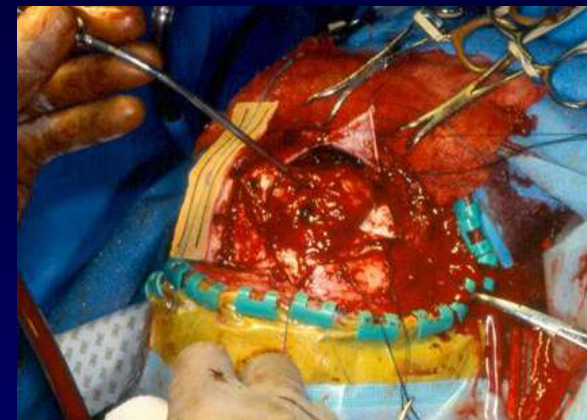
Date																			
Time (24 hour clock)																			
C O M A	Eyes open	Spontaneously																	Eyes closed by swelling = C
		To speech																	
		To pain																	
S C A L E	Best verbal response	Orientated																	Endotracheal tube or tracheostomy = T
		Conversation disorganised																	
		Inappropriate words																	
		Incomprehensive sounds																	
Best motor response		Obey commands																	Usually record the best arm response
		Localise pain																	
		Flexion to pain																	
		Flexion abnormal																	
		Extension																	
	None																		
GCS Score																			

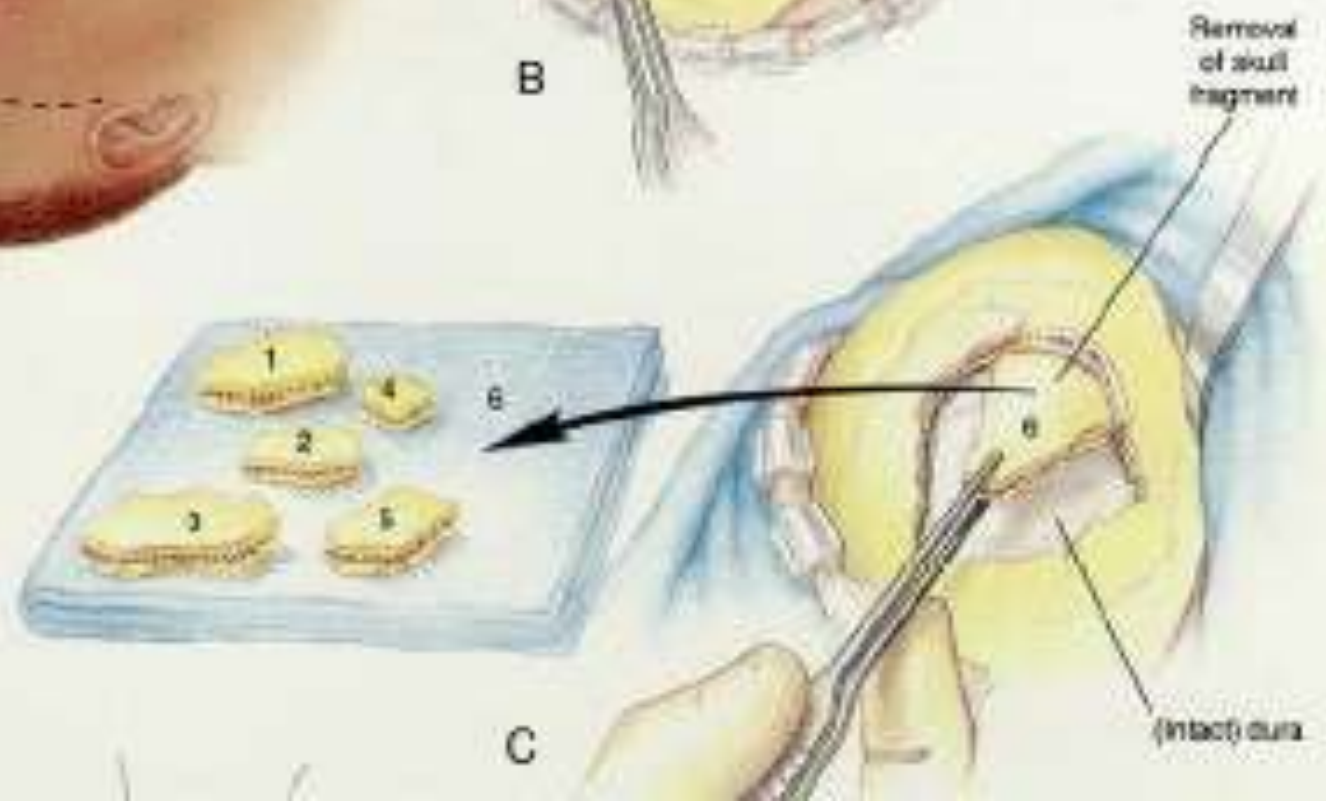
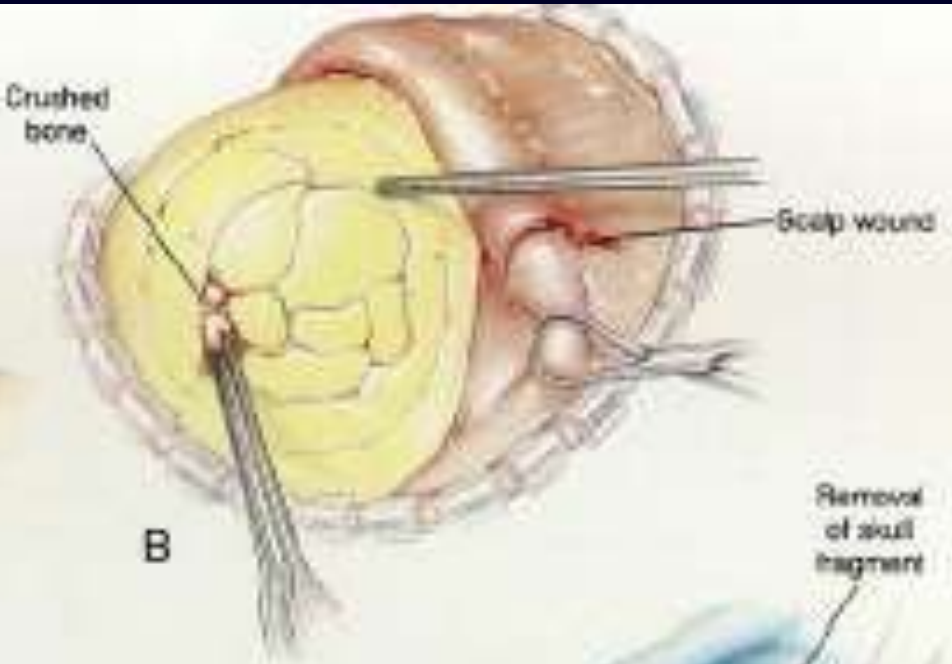


Traumatic Brain Injury

Indications for surgery:

- Focal lesion(s) surrounding oedema and midline shift
- Clotting deficiencies
- Cross-matched blood
- Exploratory burr holes !
- Compound depressed skull fracture
- Severely depressed fracture
- CSF otorrhoea and rhinorrhoea.
- Neurological status





Traumatic Brain Injury
Management:

Guideline for the Management
of Severe Traumatic Brain Injury

3rd Edition

Brain Trauma Foundation
American Association of Neurological Surgeons,
Congress of Neurological Surgeons,
Joint Section on Neurotrauma and Critical Care.

Traumatic Brain Injury

Management:

- BP < 90 mmHg systolic should be avoided
- Hypoxia Pa O₂ < 60mmHg or O₂ saturation < 90% should be avoided
- Hypothermia?
- Antiepileptic Drugs: Dilantin

Traumatic Brain Injury Management:

- Use of Steroids: **NO**
- Hyperventilation: PaCO₂ ~30-34 mmHg
- Avoid: 1st 24hrs or <25mmHg
- IV fluid: **NaCl**

Traumatic Brain Injury

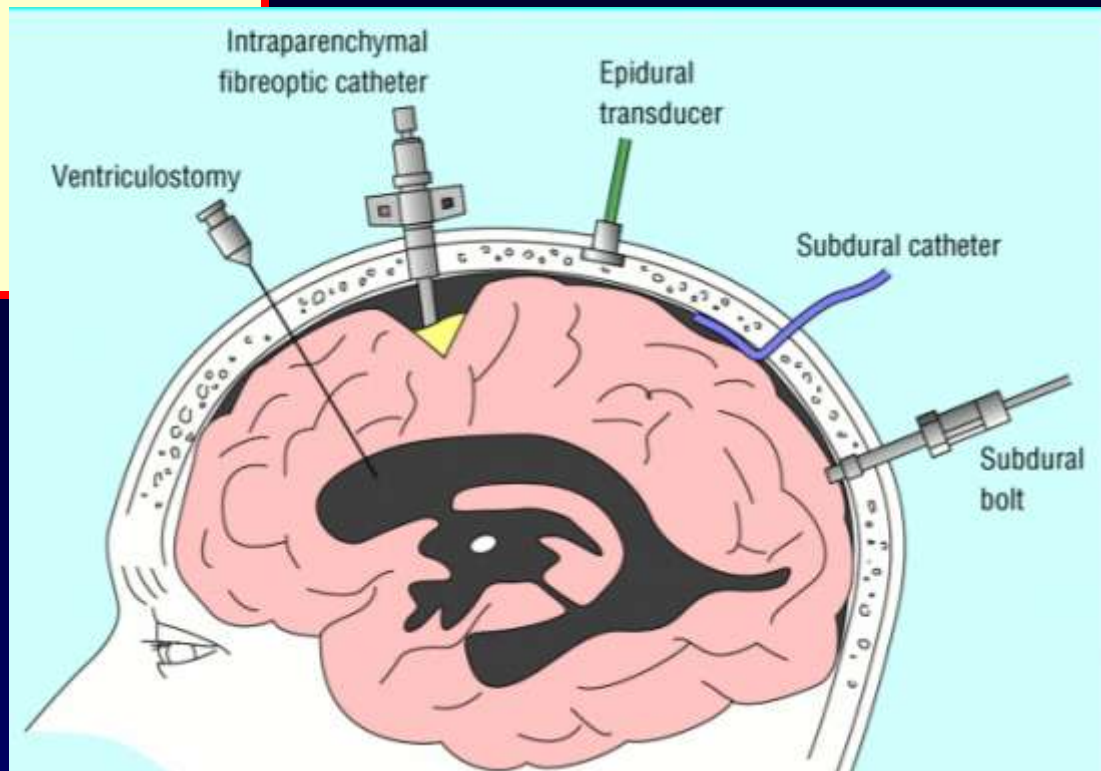
Use of Mannitol:

- Severe head injury
- Buy time during transfer
- Up to 1g/kg of intravenous mannitol (20% solution) over 30 minutes to reduce associated cerebral edema.
- Rebound phenomena
- Hyper tonic saline

Traumatic Brain Injury

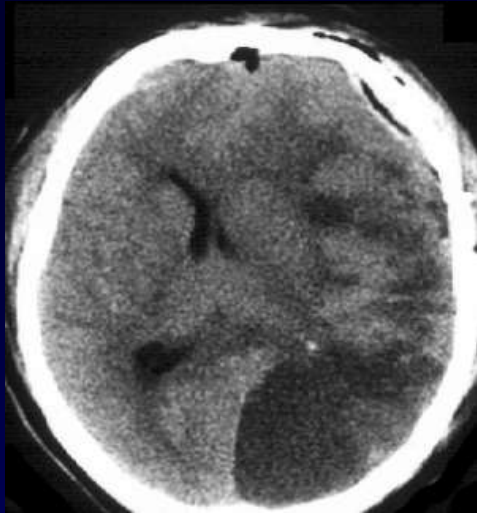
ICP monitoring:

- Indications: GCS < 8
- Unable to monitor
- Types:
- Readings:



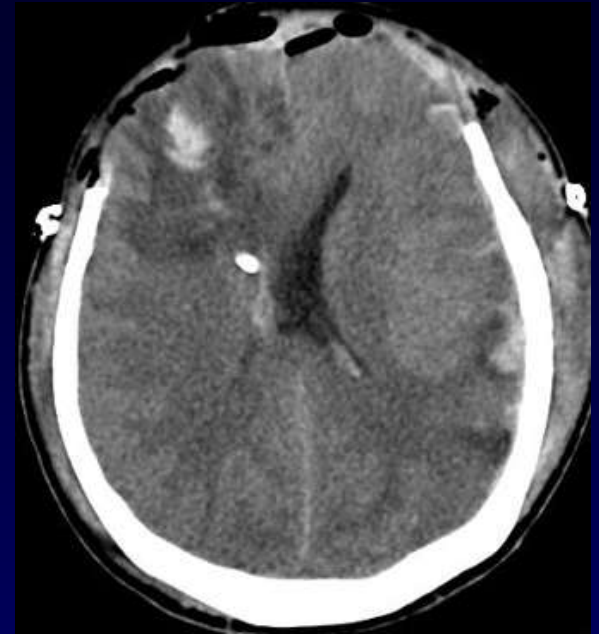
Traumatic Brain Injury Management:

Decompressive Craniectomy



Traumatic Brain Injury
Management:

Decompressive Craniectomy



Traumatic Brain Injury

Outcome:

Mild head injury (GCS:13-15): tend to do well.

Moderate head injury (GCS:9-12): fare less well.

50% good recovery

25% moderate degree of disability.

15% severe degree of disability

7-10% Death or a persistent vegetative state

Severe head injury (GCS: 3-8): worst outcomes.

20% good outcomes.

20% moderate disability

20% severe disability

40% Death or a persistent vegetative state

Traumatic Brain Injury Rehabilitation:



- Expedite Recovery
- Outpatient therapy
- Constant vigilance to prevent problems; joint mobility, skin integrity, respiratory status etc.

Traumatic Brain Injury

Prevention:

- Speeeeeeed
- Automobile seatbelts and child restraints
- Air bags ?
- Helmets by cyclists

Thank you

