Head truma and managment

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Definition

- Head injury is defined as traumatic injuries involving the cranium and intracranial structures (i.e scalp , skull or brain).
- Traumatic brain injury (TBI) and head injury are often used interchangeably .
- Maxillofacial injuries is not part of head injury.

Surgical Anatomy

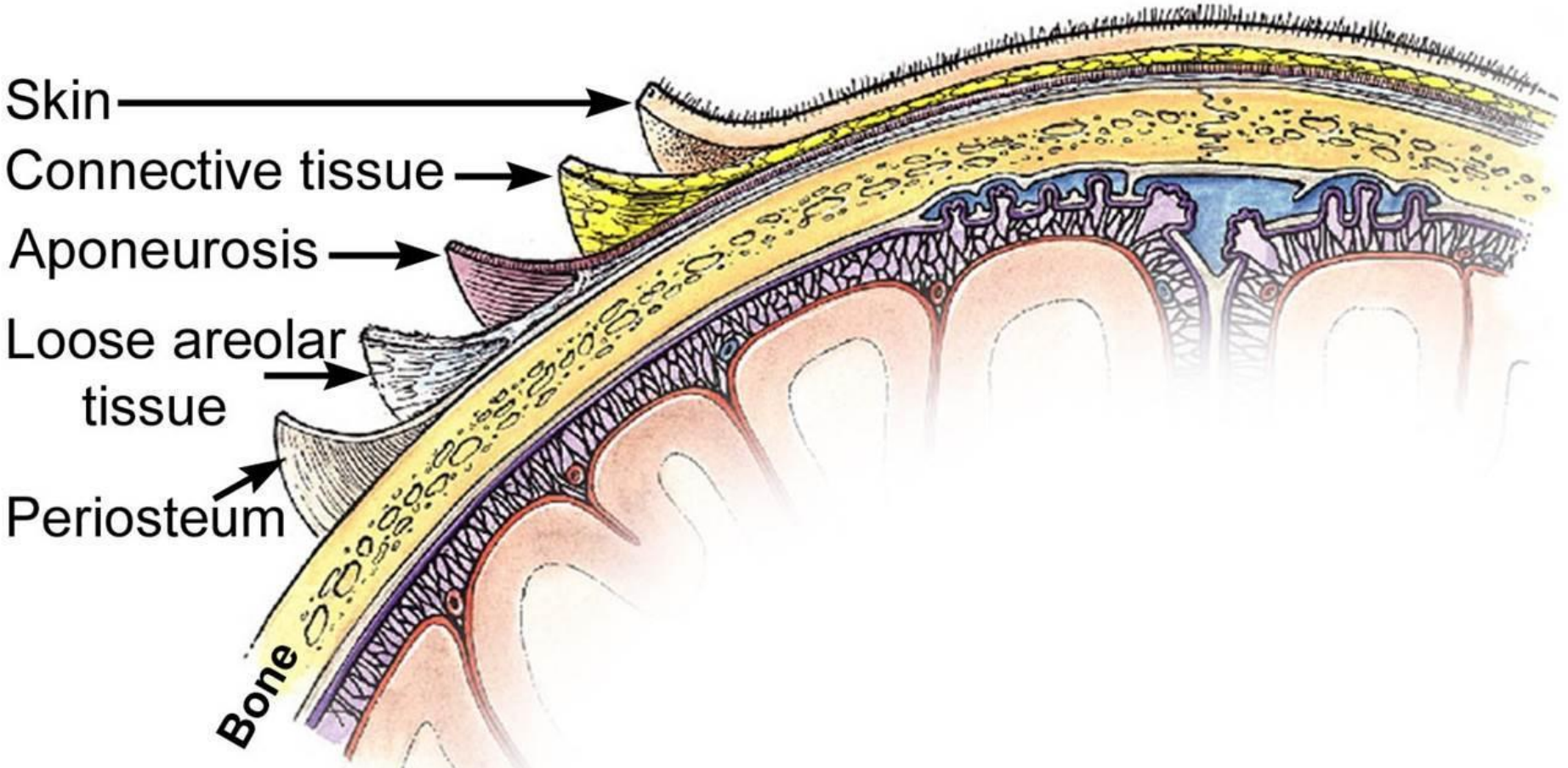


Fig 7.18 Grant's Atlas of Anatomy 12th Ed. LW&W, 2009

Epidemiology

- Head injury continues to be an enormous public health problem, even with modern medicine in the 21st century.
- Its one of the most common cause of admissions to the A & E department worldwide.
- The most common causes include motor vehicle accidents, falls, assaults, sport related injuries and penetrating trauma.
- Head injuries occur in all age groups, with peak incidence between the ages of 16 and 15 years and is more common in males than females.

Pathophysiology

- Brain is contained within the skull, a rigid and inelastic container.
- Hence only small increases in volume within the intracranial compartment can be tolerated before pressure within the compartment rises dramatically.
- A second crucial concept in TBI pathophysiology is the concept of cerebral perfusion pressure (CPP),which is the difference between the mean arterial pressure (MAP) and intracranial pressure (ICP)
- CPP = MAP - ICP

Classification : According to

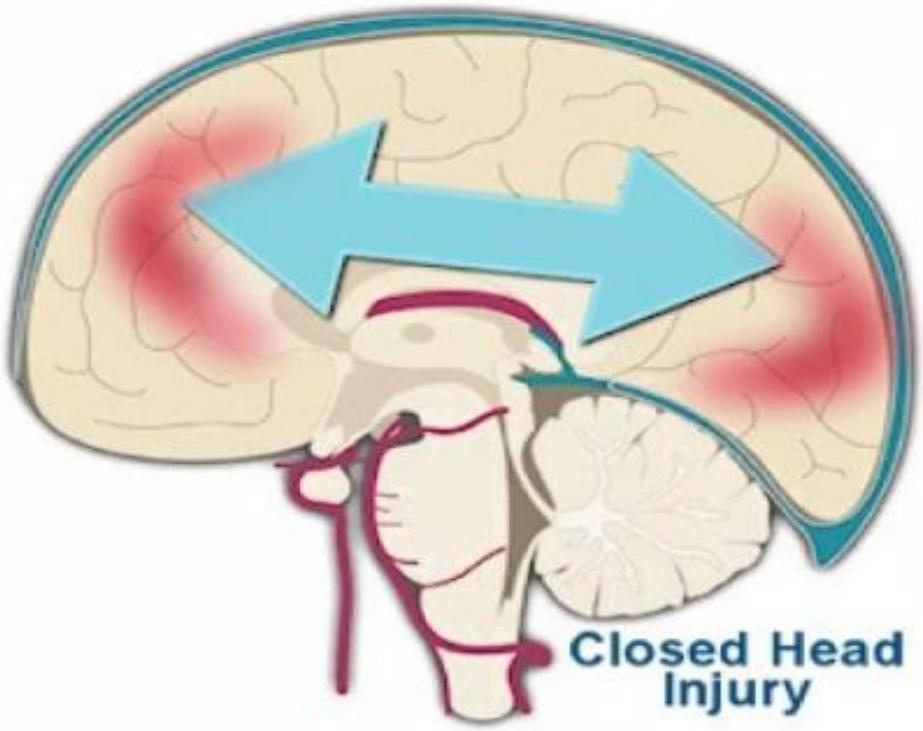
- Type of injury : open - closed or blunt - penetrating.
- Site of injury .
- Pathology of injury .
- Severity of injury .

Open injury

- Obvious external wound

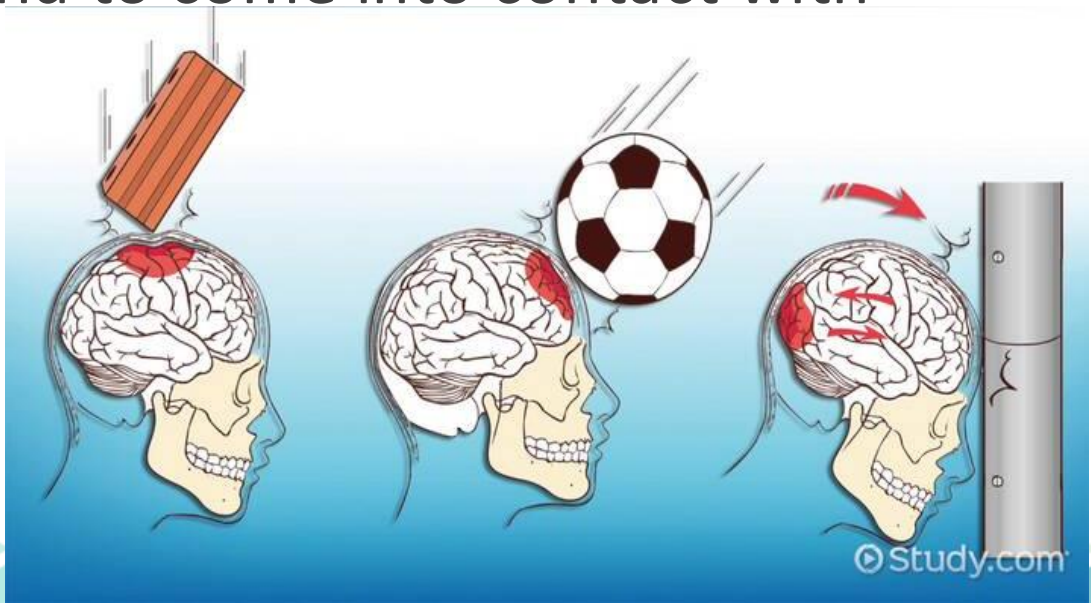
closed injury

No obvious external signs



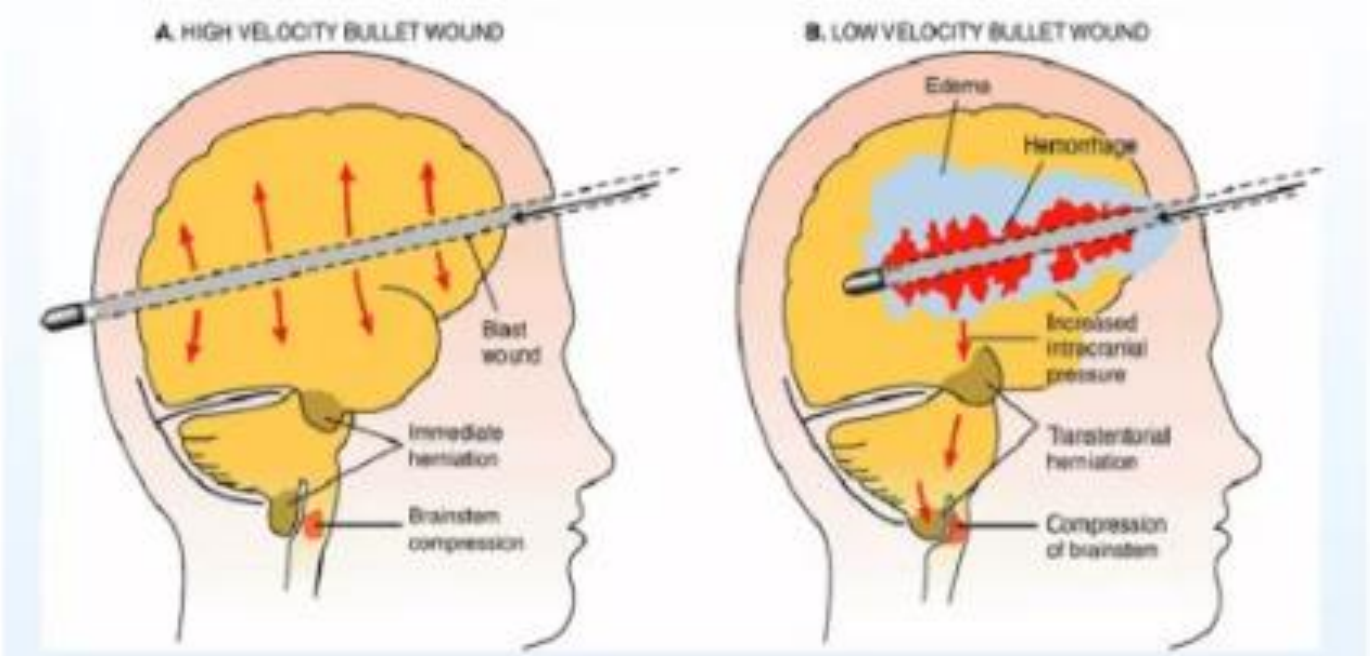
Blunt head injury

- A moving head strikes a fixed object, or a moving object strikes an immobile head - scalp injury, fractures of the skull, contused brain etc.
- Injuries resulting from rapid deceleration of the head causing the brain to move within the cranial cavity and to come into contact with the bony protuberances withing the skul



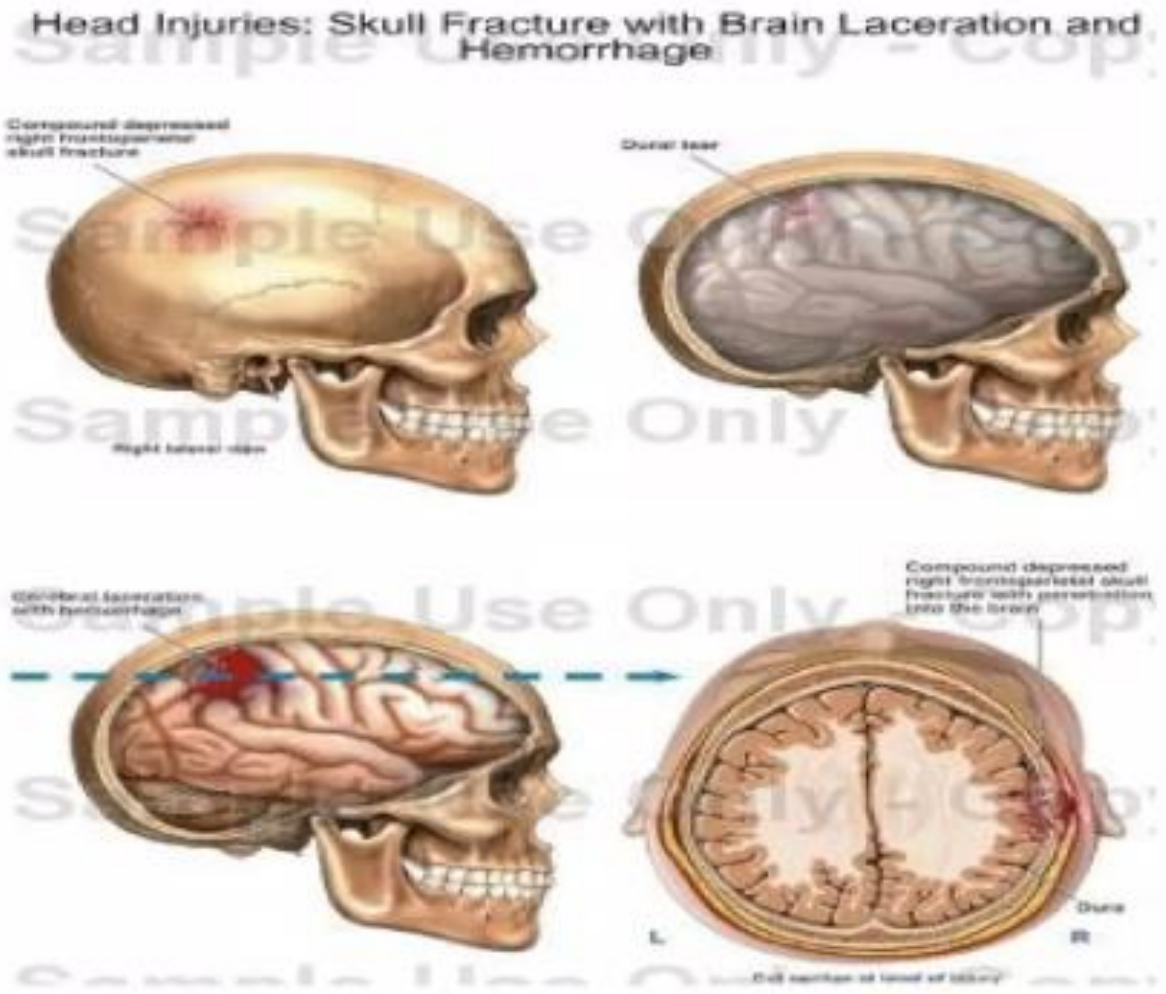
Penetrating injury

- Classified into 2 types :
- High velocity (bullets)
- Low velocity injury (knifes - arrows - screwdrivers etc)



Site of injury

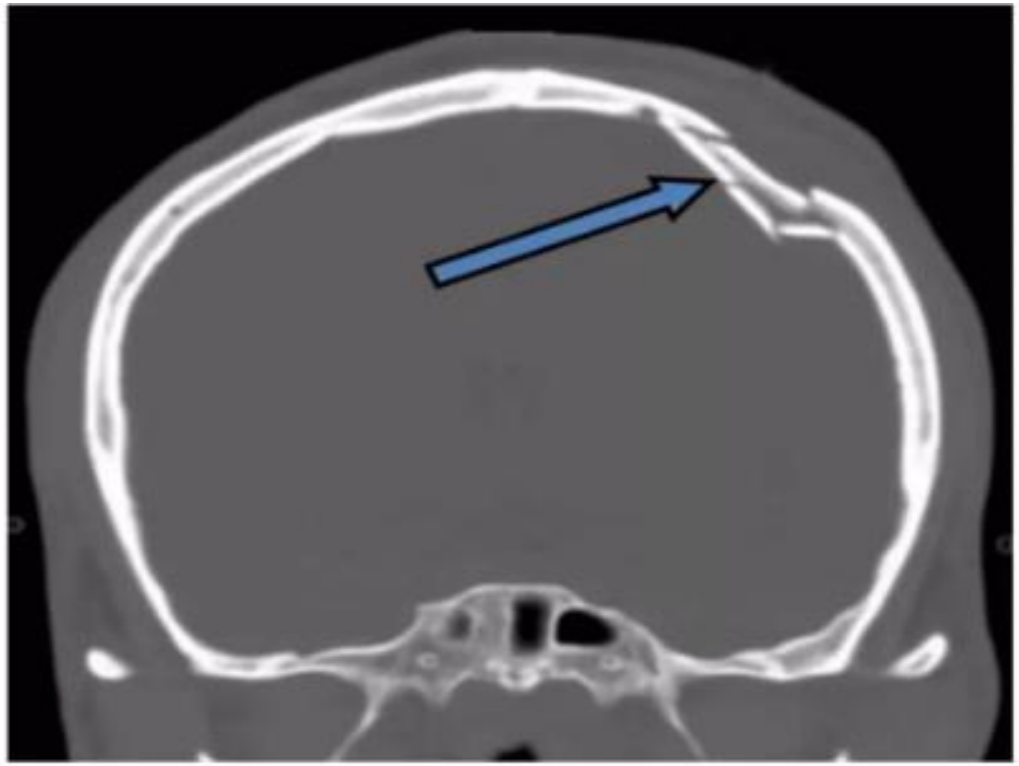
- Scalp injury
- Skull injury
- Brain injury
- Intracranial vascular injury



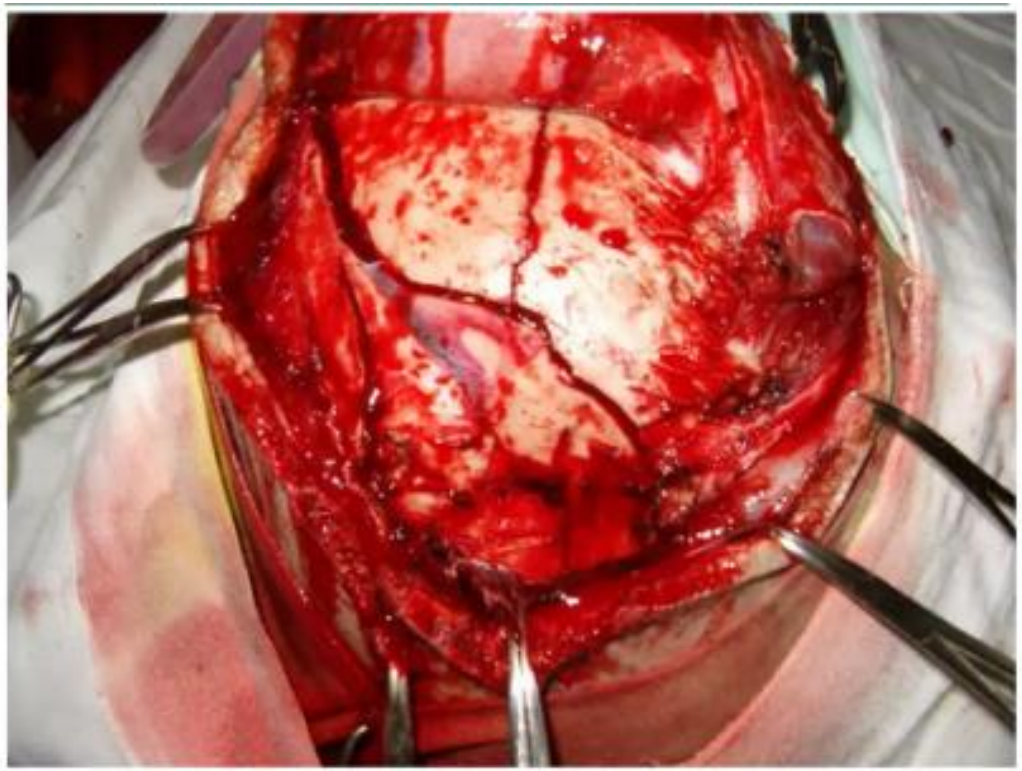
Scalp injuries

Skull injuries - fractures

- Open fractures



Closed fractures



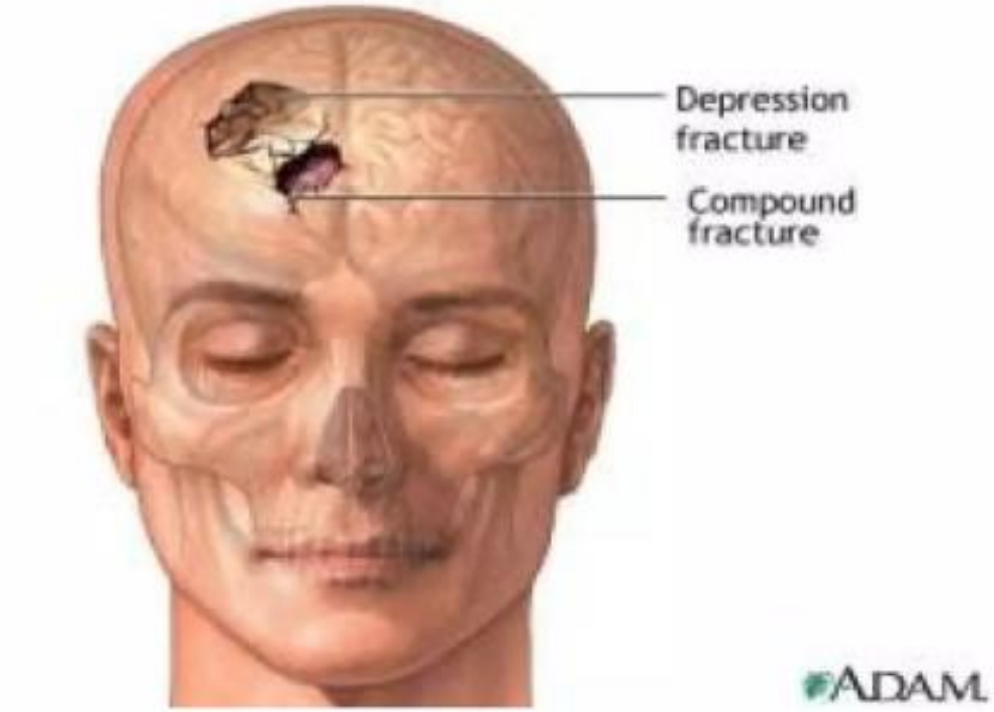
Skull injuries

- Closed fractures : has a significant chance of associated intracranial hematoma.

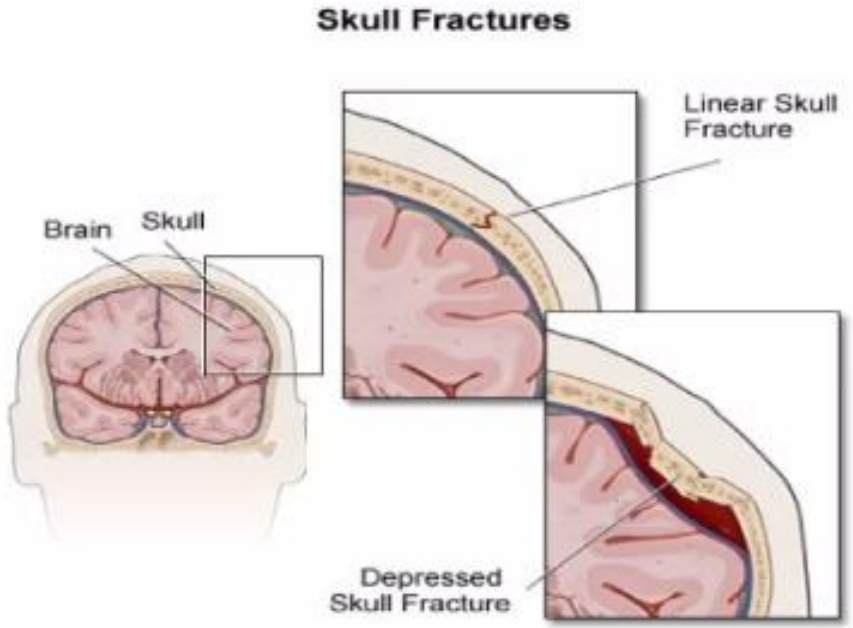
- Open fractures : have the potential for serious infection,
- Any foreign material in the skull should be left in place to be removed by neurosurgeons.
- It should be covered with light sterile dressing that has been moistened with a sterile saline.

Skull injuries - fractures

- Depressed fractures



Linear fractures



Skull injuries - basilar fractures

- (raccoon eye , battle sign)

Brain injuries

Primary

- Its the initial damage that occurs **immediately** as a result of trauma
- Cerebral concussion
- Cerebral contusion
- Cerebral laceration
- Diffuse axonal injury

Secondary

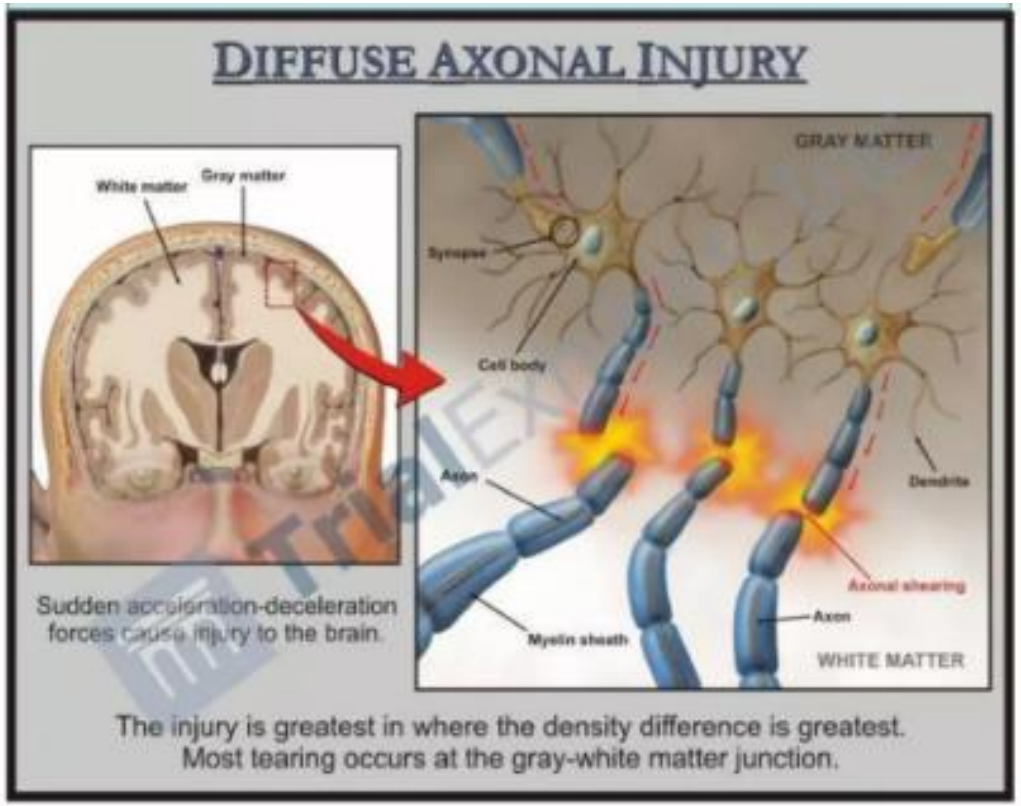
- Its the result of neurophysiological and anatomic changes, which occur from **minutes to days** after the original trauma.
- Cerebral edema
- Intracranial hematoma
- Brain herniation
- Cerebral ischemia
- Infection
- Epilepsy

Primary brain injury

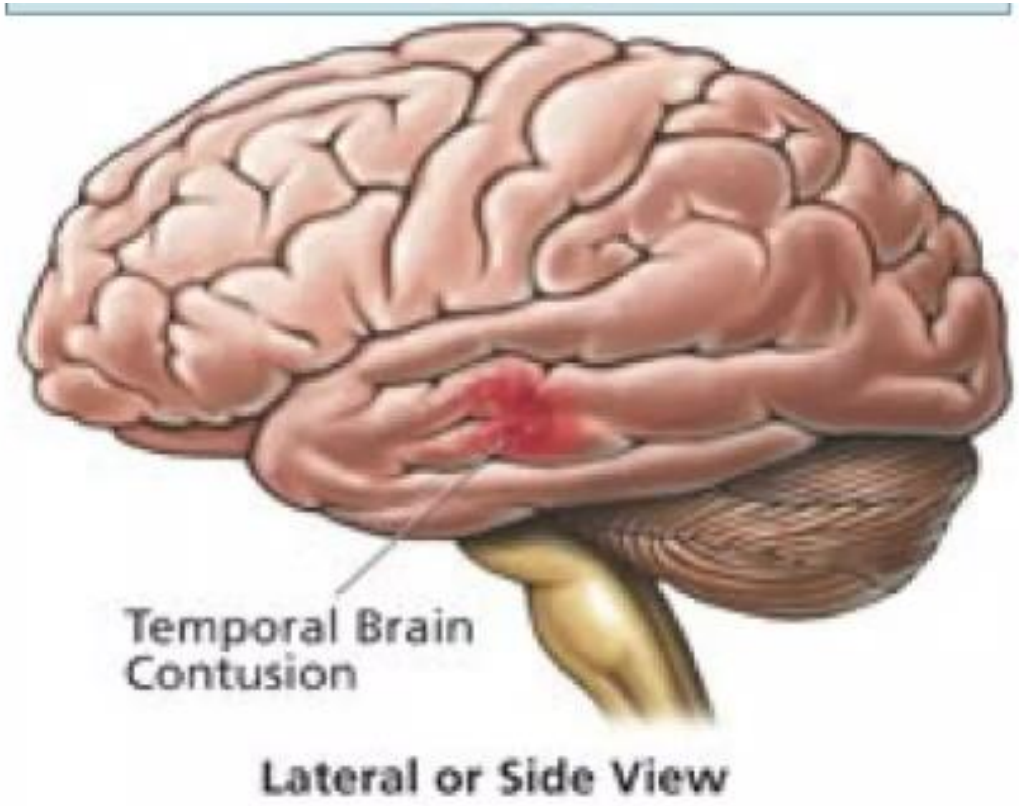
- **Cerebral concussion** : is slight distortion causing temporary physiological changes leading to transient loss of consciousness with complete recovery.
- **Cerebral contusion** : is more severe degree of damage with bruising and cerebral oedema leading to diffuse or localized changes.
- **Cerebral laceration** : is tearing of brain surface with collection of blood in different spaces and with displacement of dural parts.
- **Diffuse axonal injury** : this type of brain damage occur as a result of mechanical shearing following deceleration, causing disruption and tearing of axons, especially at the gray-white matter interfaces.

Brain injury

Diffuse axonal injury

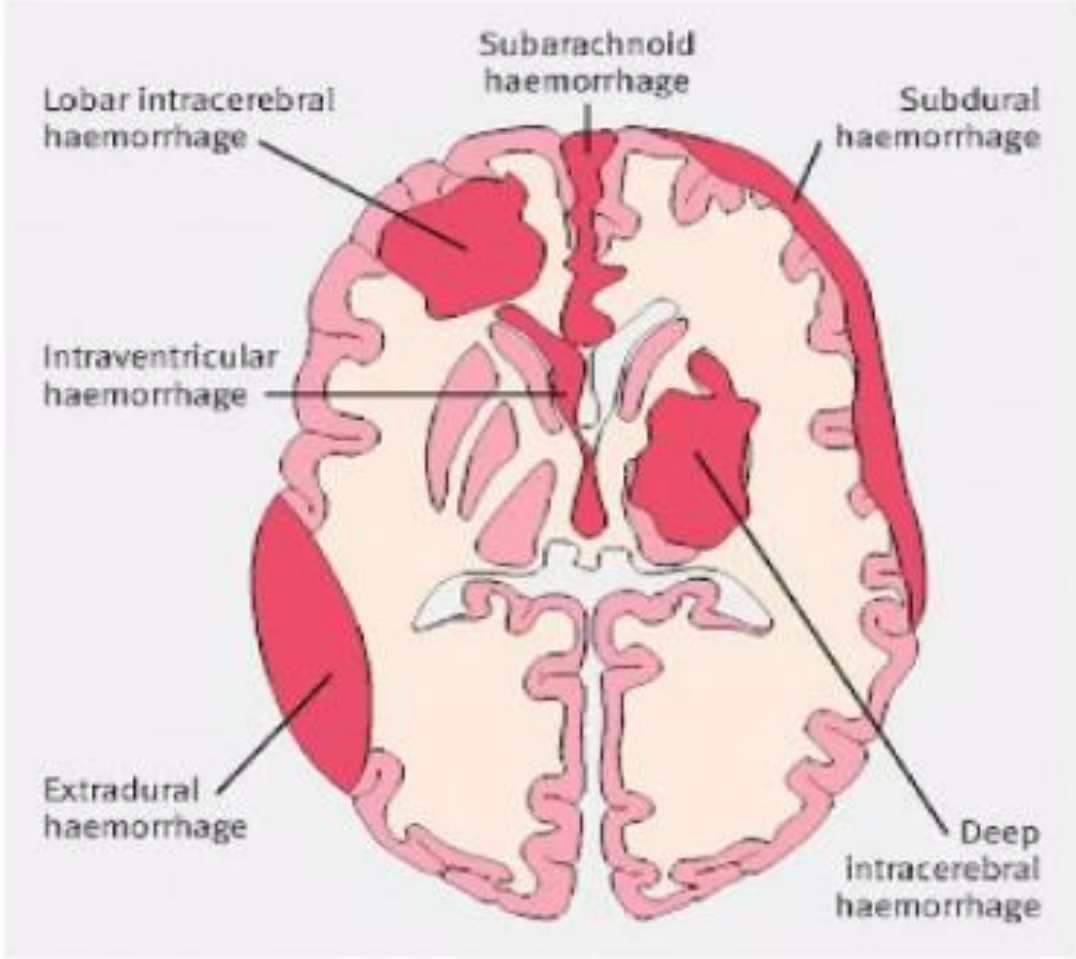


Contusion



Intracranial vascular injury

- Epidural hematoma
- Subdural hematoma
- Sub arachnoid hematoma
- Intracerebral hematoma



Extradural hematoma -

- Hematoma in the extradural space.
- Common site : temporal region
- Caused by tear in the MMA (middle meningeal artery)
- Commonly presents with lucid interval with featured of increased ICP
- CT scan : lentiform (lens shaped or biconvex) hyperdense lesion.
- The treatment of and EDH is immediate surgical evacuation via craniotomy.

Subdural hematoma - SDH

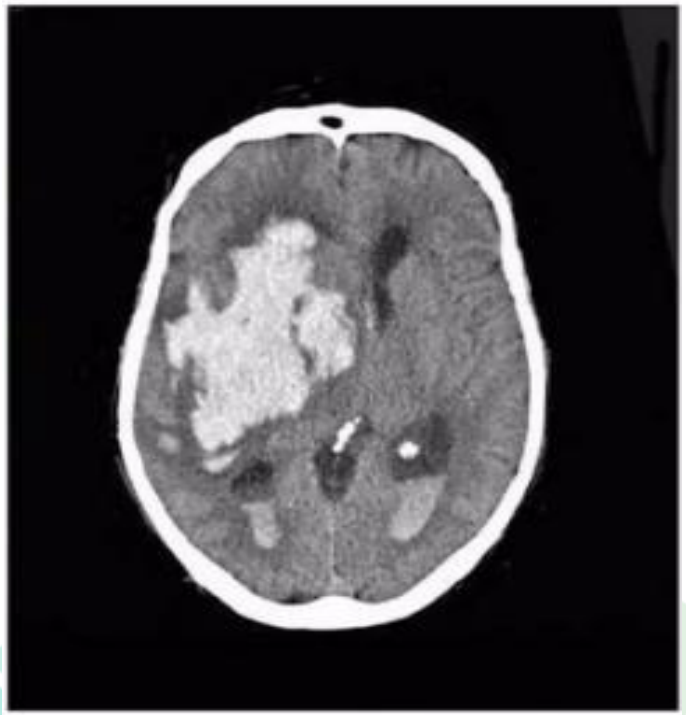
- Hematoma between dura and brain.
- Occur as a result of tearing of cortical veins and due to cortical laceration.
- Described as acute or chronic depending on the age.
- A SDH usually present with LOC from the time of injury and is progressive.
- Clinical features of CSDH include headache, cognitive decline, focal neurological deficits and seizures.
- CT scan : convex lesion
- The treatment is surgical evacuation via craniotomy.

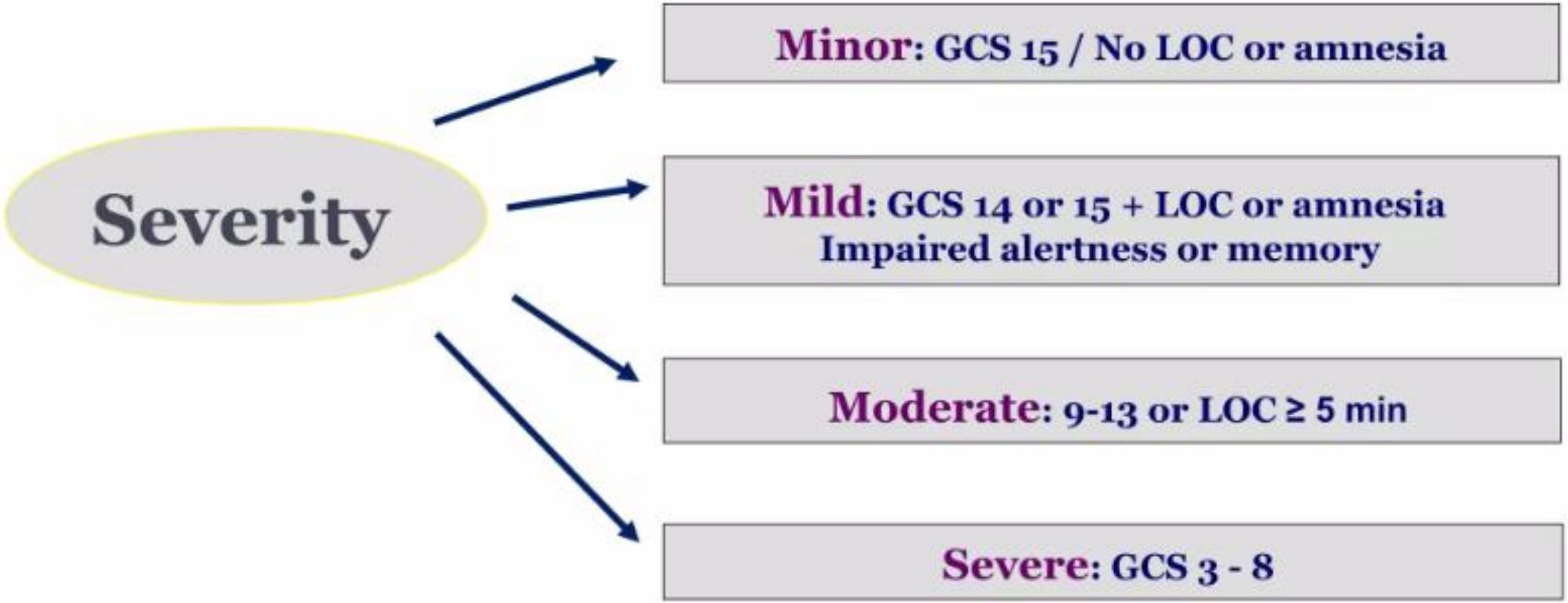
Subarachnoid hemorrhage - SAH

- Hematoma in the space between the arachnoid space and the pia mater (subaracbnoid space)
- May be spontaneous (intracranial aneurysm) or due to trauma.
- Features of increase ICP
- Diagnosed with LP - CT scan - Angiogram.
- Treatment : clipping - embolization - craniotomy.

Intracerebral hematoma - ICH

- Hematoma is formed within the brain parenchyma.
- Due to areas of contusion, coalescing into a contusional hematoma.
- CT scan : appear as hyperdense lesions with associated mass effect the midline shift.



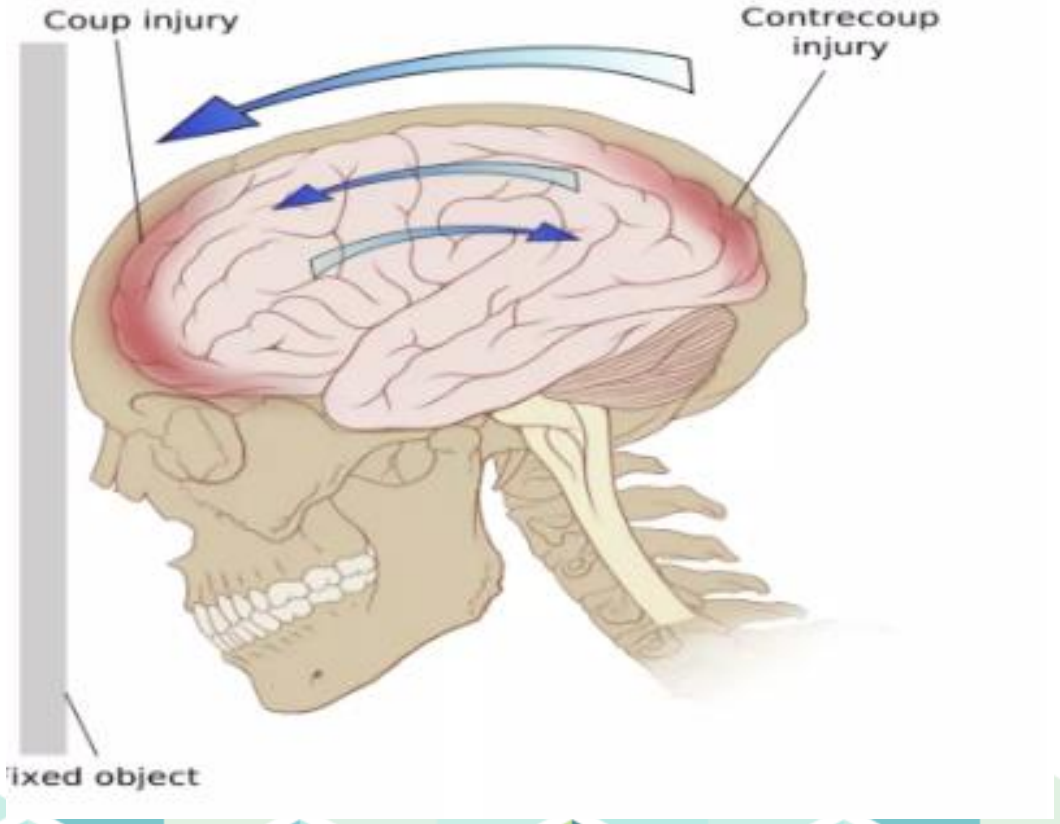

Severity
Minor: GCS 15 / No LOC or amnesia
Mild: GCS 14 or 15 + LOC or amnesia
Impaired alertness or memory
Moderate: 9-13 or LOC ≥ 5 min
Severe: GCS 3 - 8

Effects of brain injury

- **Brain oedema** : is accumulation of fluid in both the intracellular and extracellular, its due to congestion and dilatation of blood vessels, it may be diffuse or localized.
- **Brain necrosis** : is due to hemorrhagic infarction and has a variety of destruction.
- **Brain ischemia** : is due to increased pressure, this in turn leads to alteration in the perfusion of brain which itself aggravates the ischemia and this forms a vicious cycle, causing progressive diffuse ischemia of brain.
- **Coup injury** : occurs on the side of the blow to the head, **Contre-coup** injury : occur on the side opposite to the blow on the head.

Coup or contrecoup injuries

- Damage may occur directly under the site of impact (COUP), or it may occur on the side opposite to the impact (CONTERCOUP).



Coning

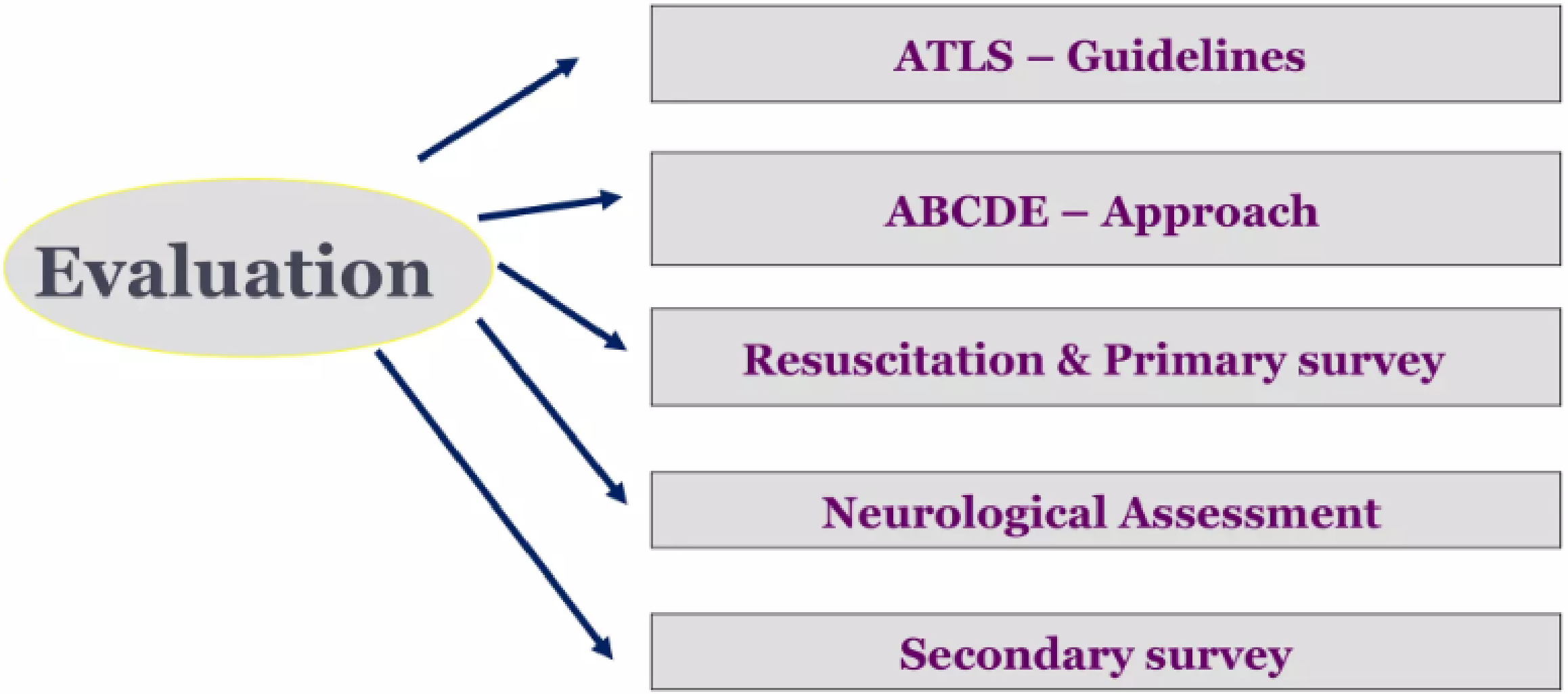
- Its due to increase ICP causing either :
- Herniation of content of supratentorial compartment through the tentorial hiatus, or
- Herniation of the content of infratentorial compartment through the foramen magnum.
- In supratentorial herniation there is compression of ipsilateral CN3 and midbrain
- In infratentorial herniation there is obstruction of cerebral aqueduct with damage to brain function.

Clinical approach

- Start with history
- Examination

History taking

- Mechanism of injury
- LOC or amnesia
- Level of consciousness at the scene and on transfer
- Current symptoms - evidence of seizure
- Hypotension or sign of hypoxia
- Pre-existing medical conditions
- Medication (especially anticoagulants) - allergies


Evaluation
ATLS – Guidelines
ABCDE – Approach
Resuscitation & Primary survey
Neurological Assessment
Secondary survey

Examination

Neurological Assessment

- Level of consciousness
- Glasgow coma scale
- Pupillary reaction to light and size
- Vital signs
- Reflexes
- Limb movements : normal - mild weakness - severe weakness - spastic flexion - extension - no response

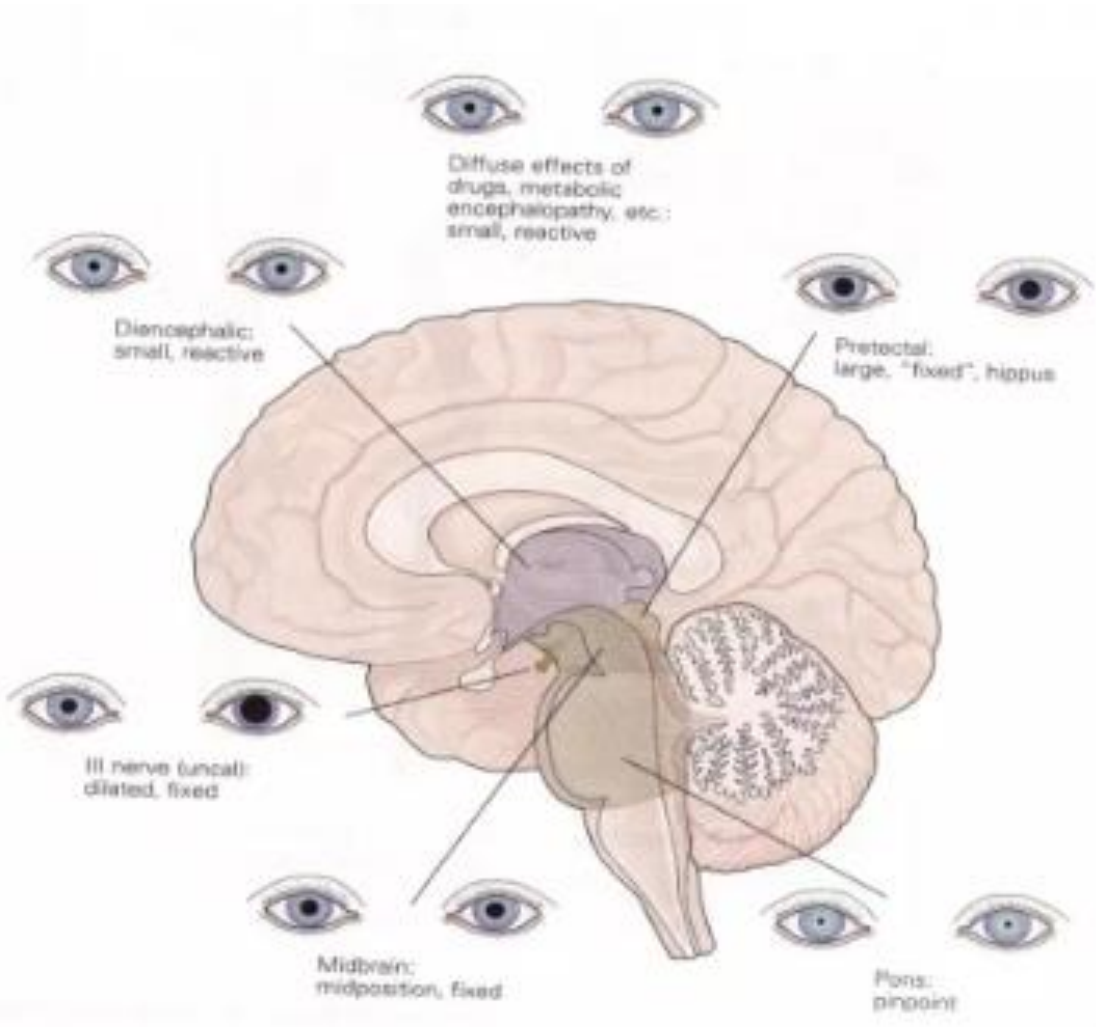
Secondary survey

- General assessment and other injuries like fractures, abdominal organ injuries, thoracic injuries.
- Presence of any scalp hematoma, fractures of skull bone, may be depressed.
- And blood from nose or ear, CSF rhinorrhea of CSF otorrhea.

GCS

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

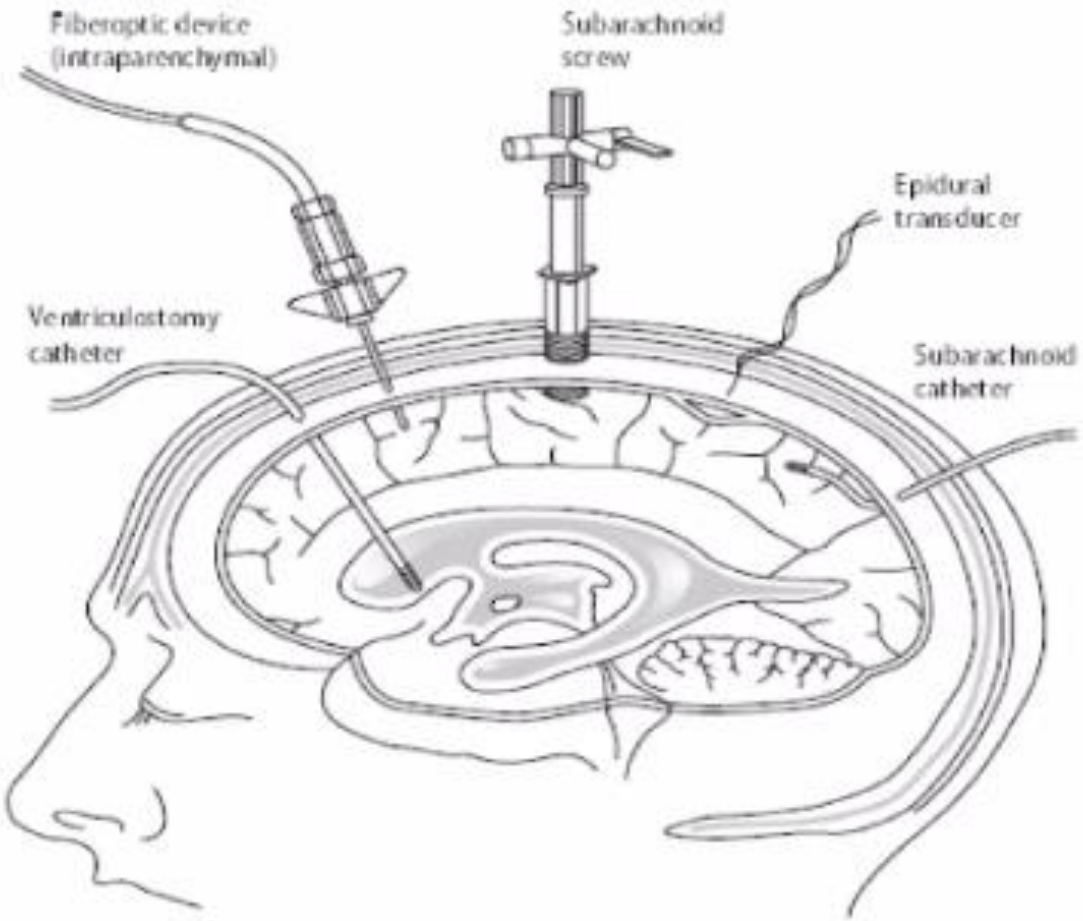
Pupillary response



Investigations

- Basic labs
- X-rays skull : to look for fracture
- CT scan : plain (no contrast) to look for cerebral oedema, hematoma, midline shifts, fractures, venticles, brainstem injury.
- Carotid arteriography - MRI scan
- Investigations for other injuries like U/S abdomen
- Monitoring of intracranial pressure.

ICP - monitoring



Criteria for hospitalization

- Any altered level of consciousness.
- Skull fracture.
- Focal neurological features.
- Persistent headache, vomiting, systolic hypertension, bradycardia.
- No CT scan available or abnormal CT head.
- Alcohol intoxication.
- Bleeding from ear or nose.
- Associated injuries.

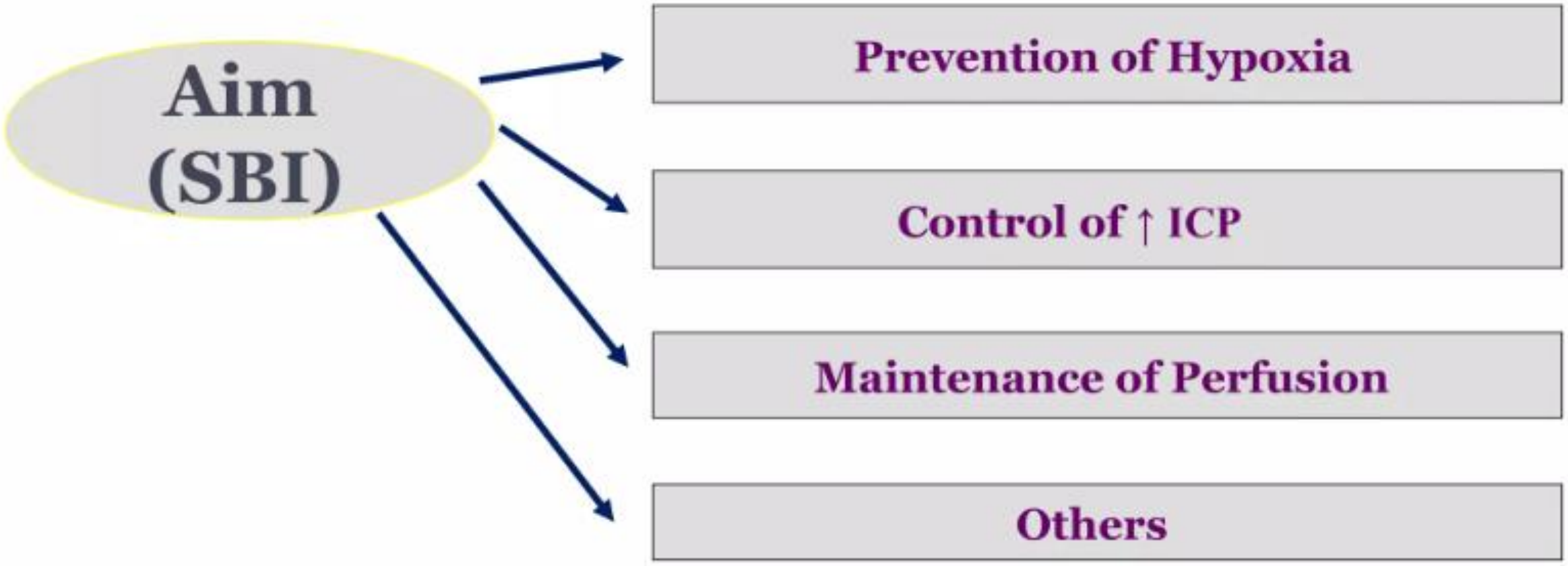
NICE Guideline - CT scan criteria

- GCS < 13 at any point.
- GSC 13 or 14 at 2 hr.
- Focal neurological deficit.
- Suspected open, depressed or basal skull fracture.
- Seizure.
- Vomiting > 1 episode.

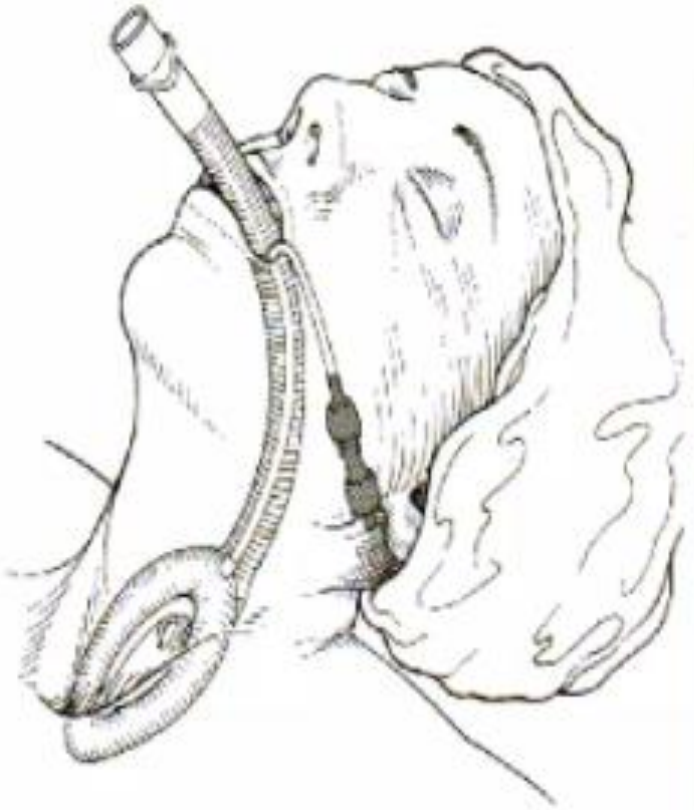
Discharge Criteria

- GCS 15\15.
- No focal neurological deficit.
- Follow up.

Treatment - Moderate to Severe Injury



Cervical Immobilization Resuscitation



Control of ICP - Medical

- Normal ICP = 8-12 mm hg
- Position head up 30 degree.
- Avoid obstruction of venous drainage - head.
- Sedation, muscle relaxant.
- Normocapnia 4.5-5 kPa.
- Diuretics : furosemide, mannitol.
- Seizure control.
- Normothermia.
- Sodium balance.
- Barbiturates.

Control of ICP - surgical

- Early evacuation of focal hematoma: EDH, ASDH (burr-hole - craniotomy).
- Cerebrospinal fluid drainage via ventriculostomy.
- Delayed evacuation of swelling contusions.
- Decompressive craniectomy.

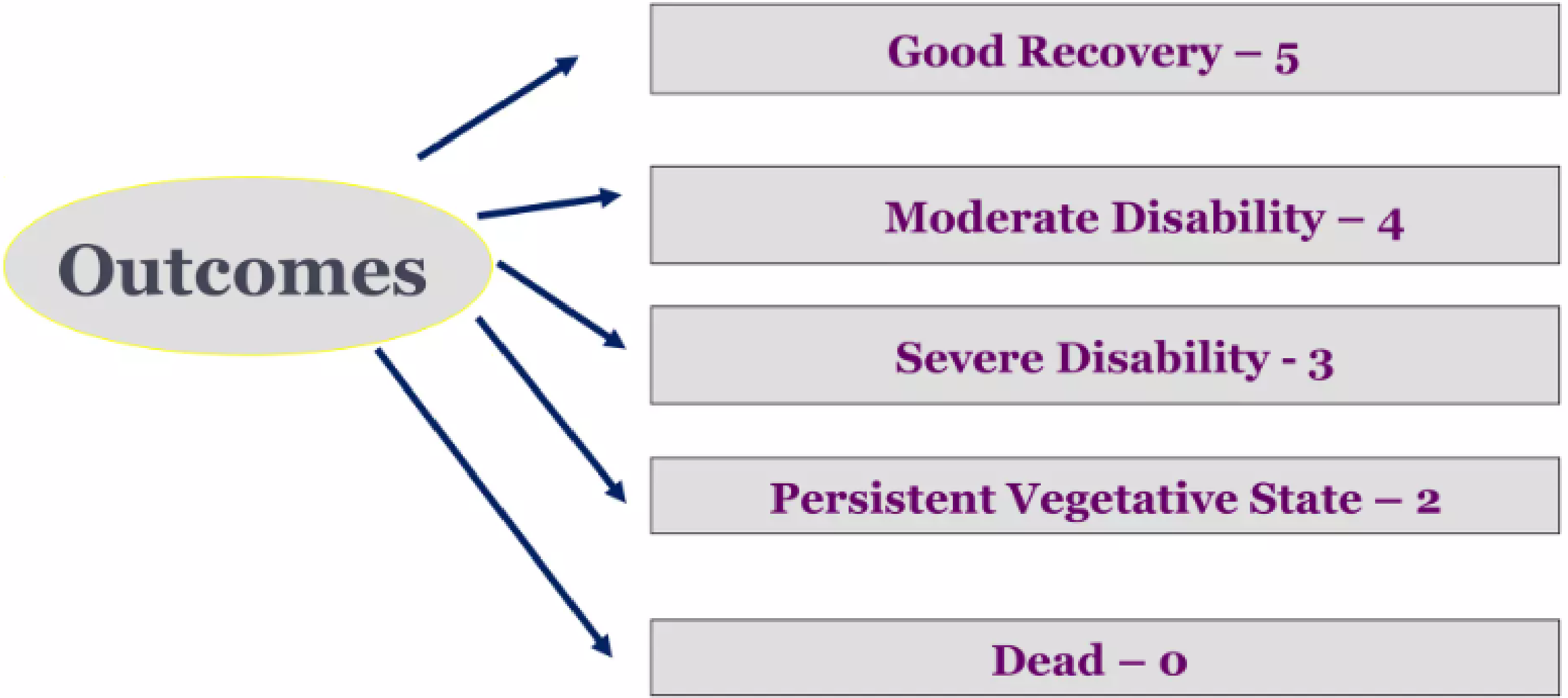
Complication

Early

- Brainstem injury - due to coning.
- Compression over cerebellum and medulla.
- CSF rhinorrhea \ CSF - leak.

Late

- Chronic subdural hematoma.
- Early post-traumatic epilepsy, they need anticovulsants for 3 years.
- Late post-traumatic epilepsy is due to scarring and gliosis of cerebrum.
- Post-traumatic amnesia.
- Post-traumatic hydrocephalus.
- Post-traumatic headache.


Outcomes
Good Recovery – 5
Moderate Disability – 4
Severe Disability - 3
Persistent Vegetative State – 2
Dead – 0

Thank you