

الطب والجراحة لجنة

Head truma

Done by:
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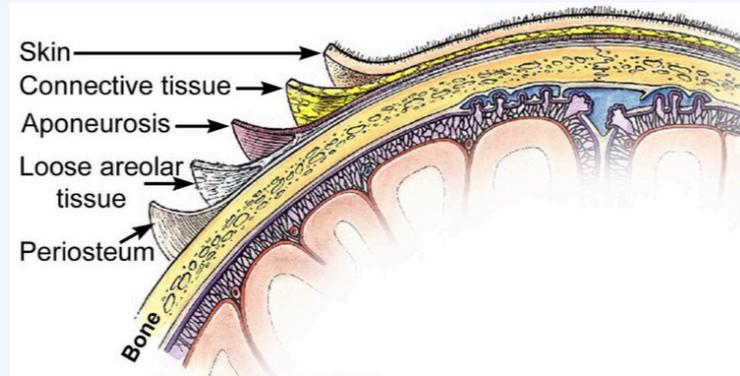
Designed by:
بيان محمود

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



Epidemiology

- Head injury continues to be an enormous public health problem, even with modern medicine in the 21st century.
- It is one of the most common cause of admissions to the A & E department worldwide.
- The most common causes include motor vehicle accidents **or (RTA)**, 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)
- $CPP = MAP - ICP$

• (Brain tissue 🧠 + Blood 🩸 + CSF 💧) there is dynamic interaction between these components to maintain Constant intra cranial pressure ICP inside the skull .

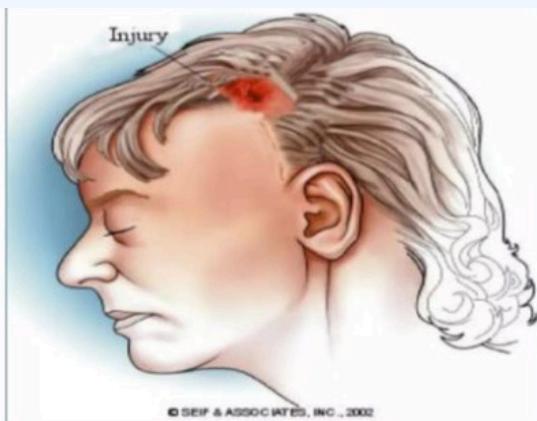
This interaction is working within specific limit of changing in pressure , otherwise when the change in intracranial pressure is huge or dramatically rise the brain can't tolerate this ,, so eventually brain damage happens! .

Classification : According to

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

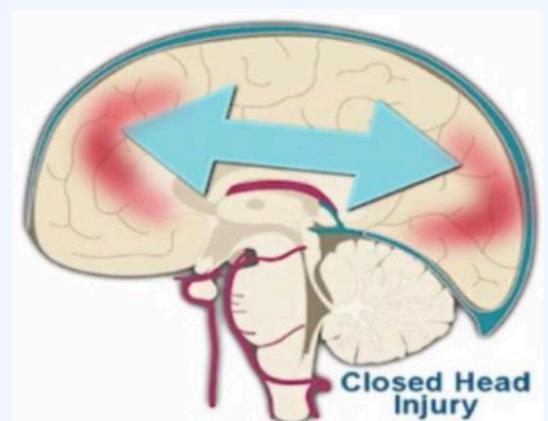
Open injury

- Obvious external wound.



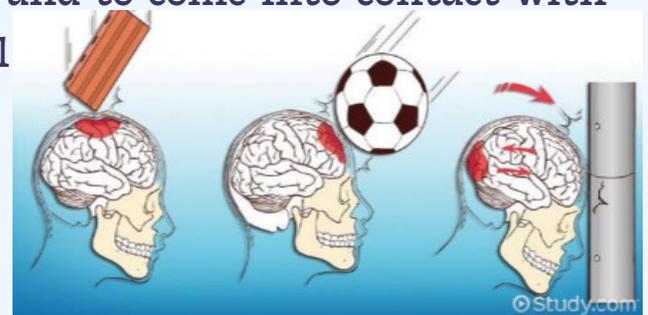
closed injury

No obvious external signs



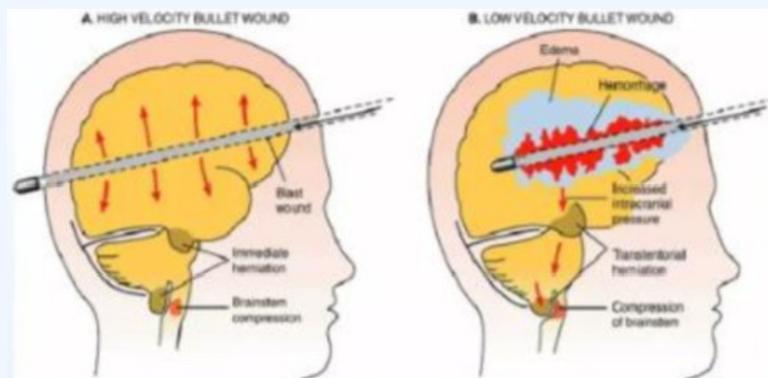
Blunt head injury (similar to closed)

- 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 crainial cavity and to come into contact with the bony protuberances withing the skull



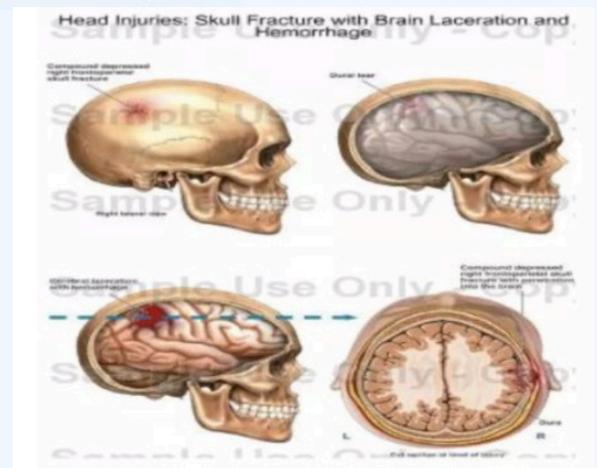
Penetrating injury

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



Site of injury

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



Scalp injuries

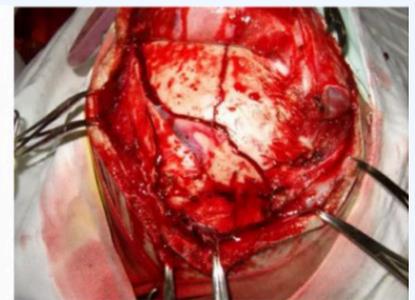
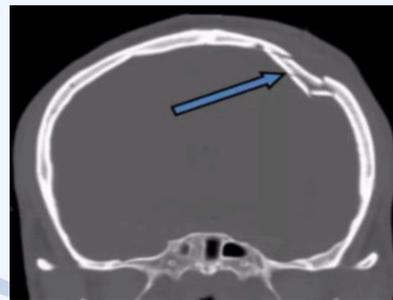
(Bone & brain tissue are intact !)



Skull injuries - fractures

• Open fractures

Closed fractures



Skull injuries

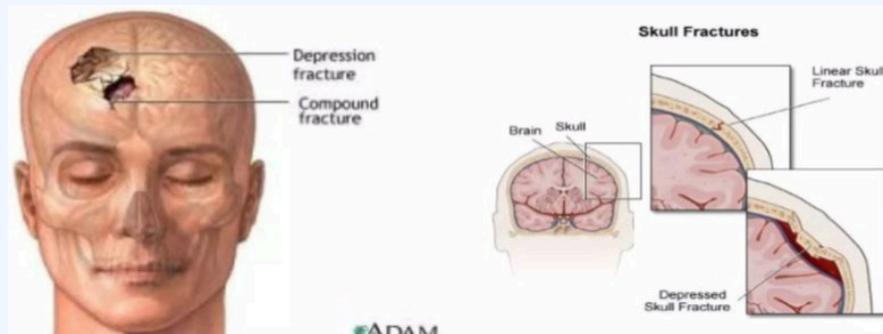
- Closed fractures : has a significant chance of associated intracranial haematoma.
- Open fractures : have the potential for serious infection,
- Any foreign material in the skull should be left in place to be removed by neurosurgeons.
- It should be covered with light sterile dressing that has been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

Skull injuries - fractures

- Depressed fractures
- Linear fractures.

basilar fractures

- (raccone eye , battle sign(around the ears))



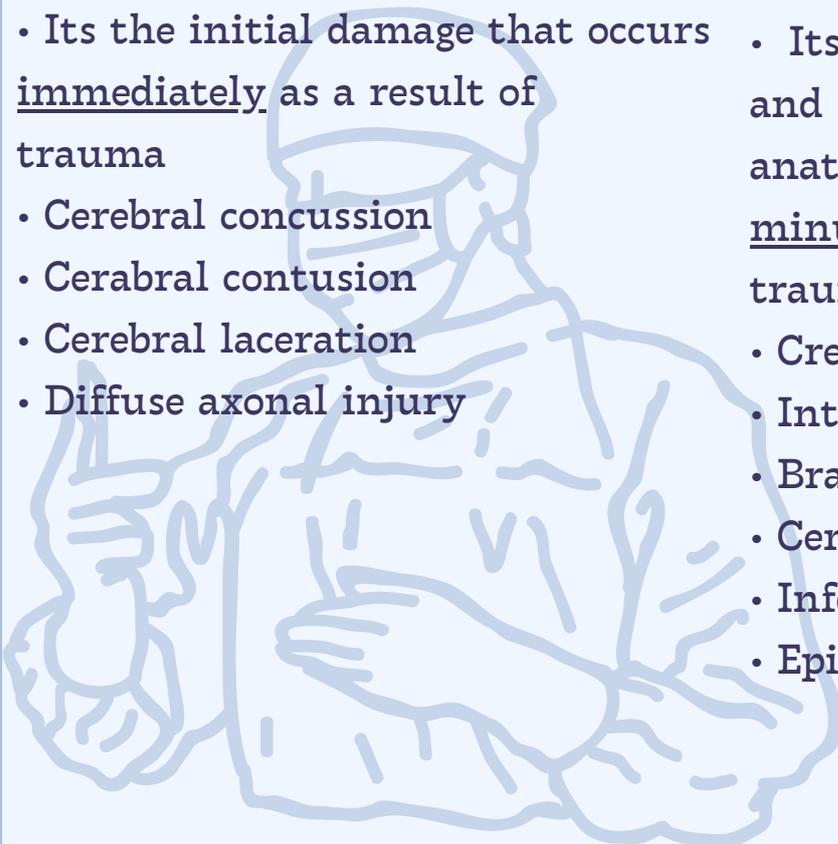
Brain injuries

Primary

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

Secondary

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

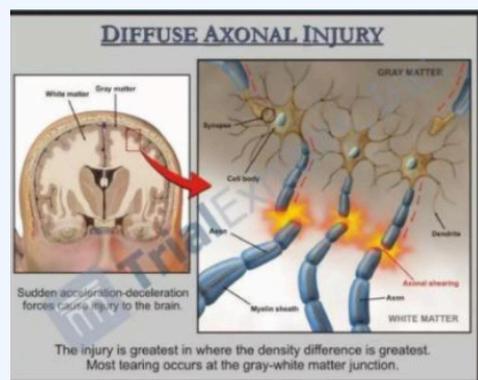


Primary brain injury

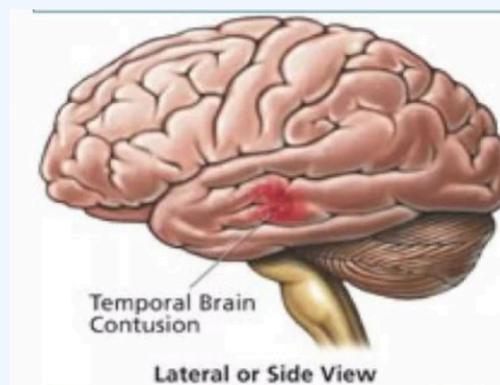
- Cerebral concussion ارتجاج : is slight distortion causing temporary physiological changes leading to transient loss of consciousness with complete recovery.
- Cerebral contusion رضة: is more severe degree of damage with bruising and cerebral oedema leading to diffuse or localized changes.
- Cerebral laceration تمزق/جرح: 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 occurs as a result of mechanical shearing following deceleration, causing disruption and tearing of axons (involve more than one nerve), especially at the gray-white matter interfaces.

Brain injury

Diffuse axonal injury.



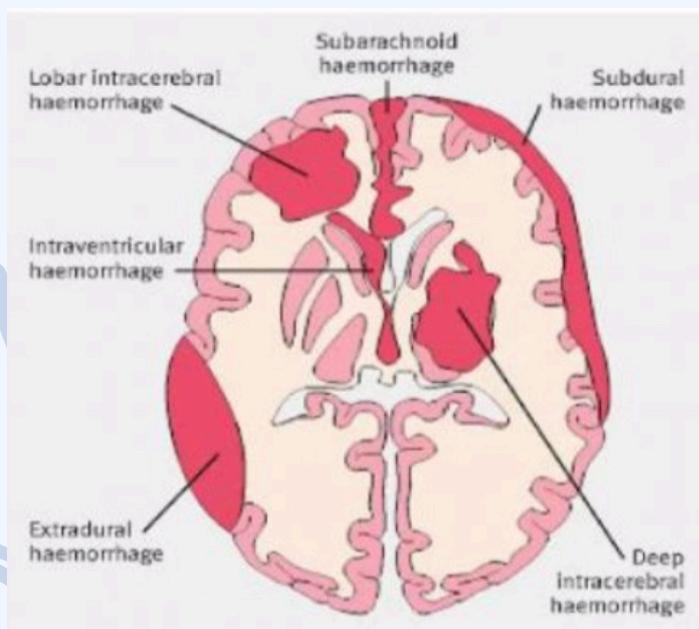
Contusion



Intracranial vascular injury

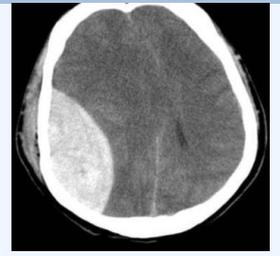
- Epidural haematoma
- Subdural haematoma
- Sub arachnoid haematoma
- Intracerebral haematoma

المقارنة بينهم مهمة جدا



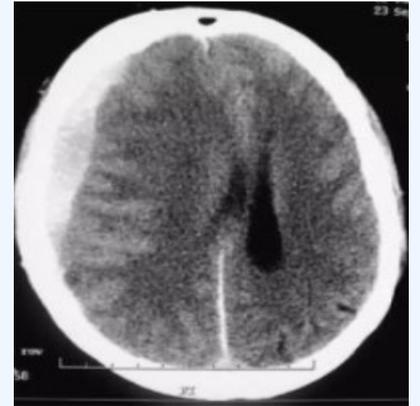
Extradural haematoma - EDH

- Haematoma in the extradural space.
- Common site : temporal region
- Caused by tear in the MMA (middle meningeal artery).
- Commonly presents with lucid interval (the patient looks well , no visible changes after the injury , BUT after hours or day patient develop sudden collapse because of failure to maintain normal ICP) 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.



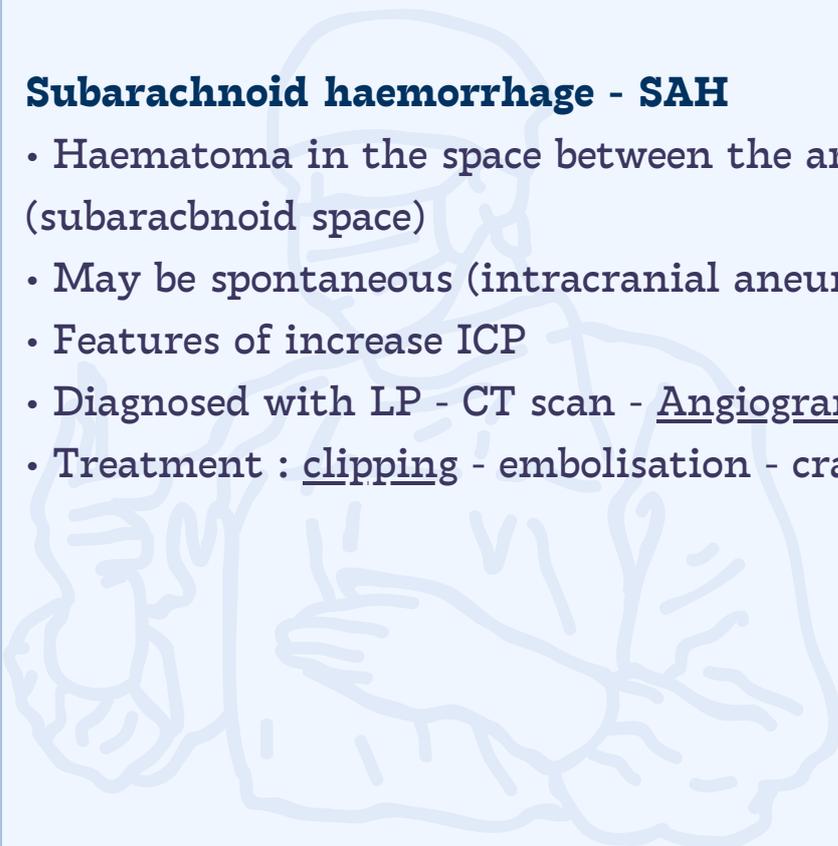
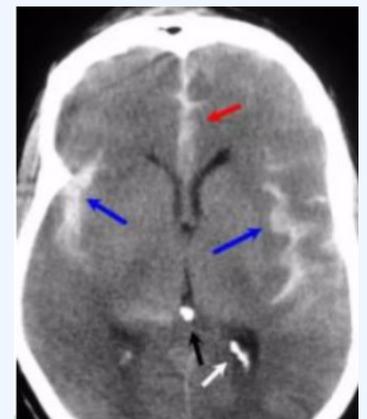
Subdural haematoma - SDH

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



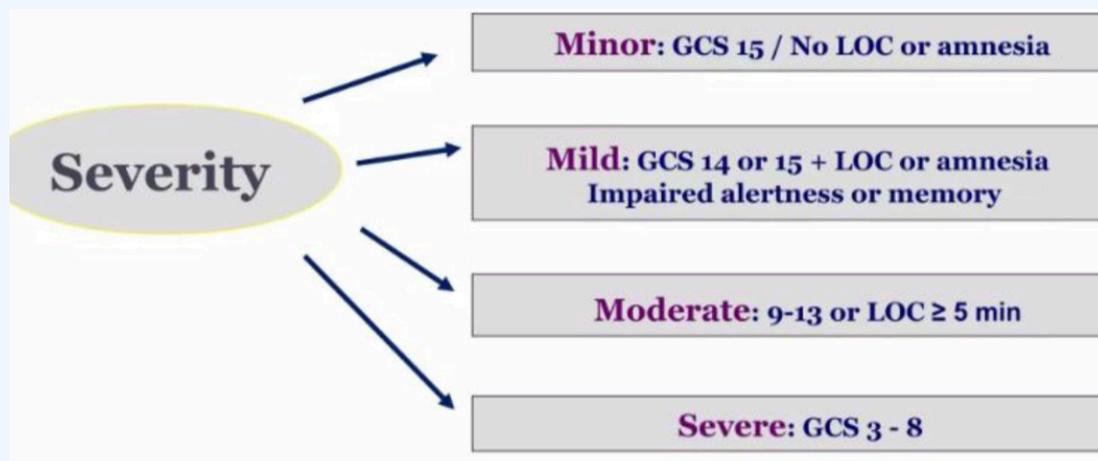
Subarachnoid haemorrhage - SAH

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



Intracerebral haematoma - ICH

- Haematoma is formed within the brain parenchyma.
- Due to areas of contusion, coalescing into a contusional haematoma.
- CT scan : appear as hyperdense lesions with associated mass effect the midline shift. (mass effect cause : midline shift + collapsed ventricles)



Effects of brain injury

- Brain oedem : 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 haemorrhagic infarction and has a variety of destruction.
- Brain ischaemia : is due to increased pressure, this in turn leads to alteration in the perfusion of brain which itself aggravates the ischaemia and this forms a vicious cycle, causing progressive diffuse ischaemia of brain.

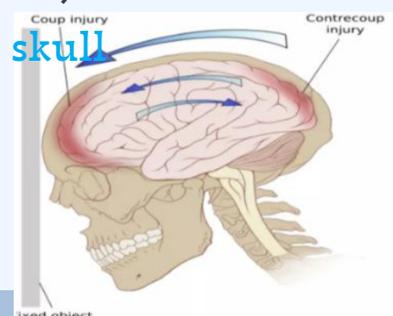
Cycle : injury \rightarrow edema \rightarrow ischemia \rightarrow Necrosis \rightarrow edema \rightarrow (will cause vasoconstriction so more and more ischemia)

- Coup injury : occurs on the side of the blow to the head, Contre-coup injury : occurs 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).

The most common sites are bony prominences of the skull



Coning [herniation]

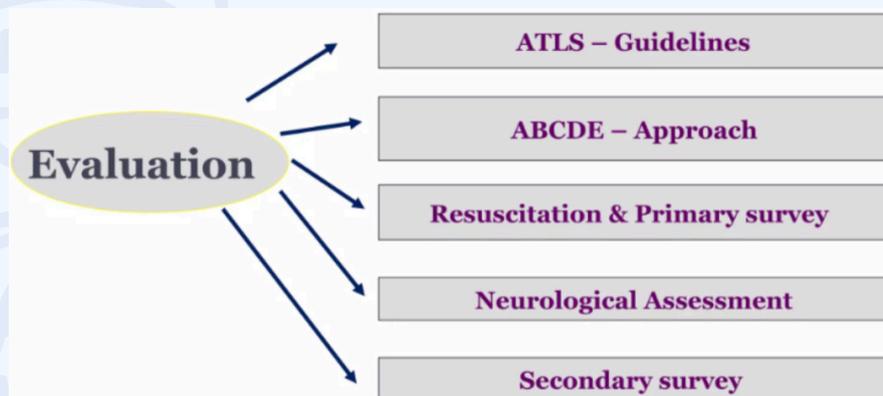
- Its due to increase ICP causing either :
- Herniation of content of supratentorial compartment through the tentorial hiatus, or
- Herniation of the content of infratentorial compartment through the foramen magnum.
- In supratentorial herniation there is compression of ipsilateral CN3 and midbrain
- 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 signs of hypoxia
- Pre-existing medical conditions
- Medication (especially anticoagulants) - allergies



Neurological assessment is done before 2ry survey

Examination

Neurological Assessment

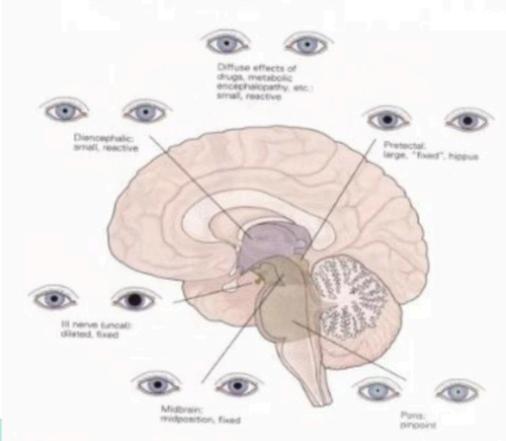
- Level of consciousness
- Glasgow coma scale
- Pupillary reaction to light and size
- Vital signs
- Reflexes
- Limb movements : normal - mild weakness - severe weakness - spastic flexion - extension - no response

Secondary survey (examine the patient from head to toes)

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

اهم حفظ

GCS	Pupillary response
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

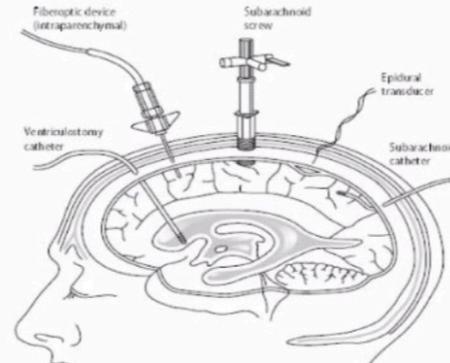


Investigations (considered as part of 2ry survey)

- Basic labs
- X-rays skull : to look for fracture
- CT scan : plain (no contrast) to look for cerebral oedema, haematoma, midline shifts, fractures, ventricles, brainstem injury.
- Carotid arteriography - MRI scan
- Investigations for other injuries like U/S abdomen
- Monitoring of intracranial pressure. (The most important if you suspect brain injury in your patient)

ICP - monitoring

Ventriculostomy is the most common procedure to monitor ICP



Criteria for hospitalization

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

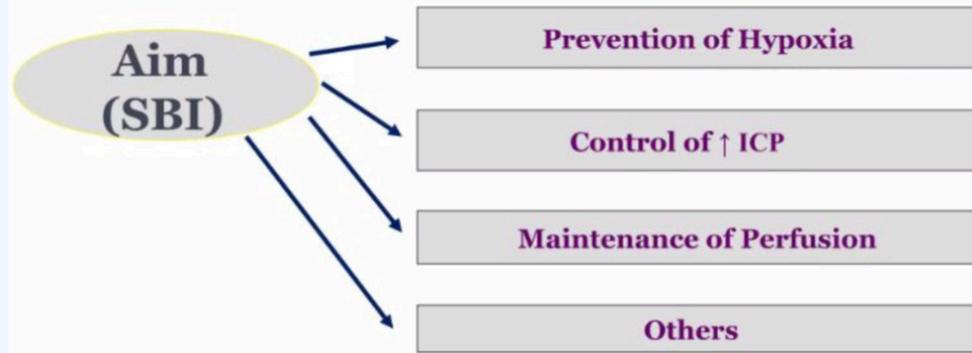
NICE Guideline - CT scan criteria

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

Discharge Criteria

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

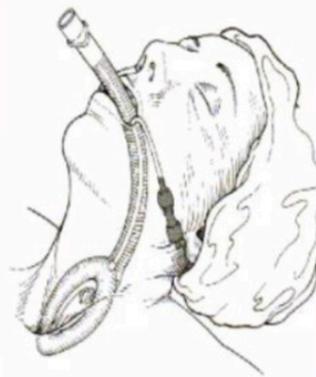
Treatment - Moderate to Severe Injury



ASO

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. (seizure)

You need to differentiate between Medical and surgical control !

Control of ICP - surgical

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

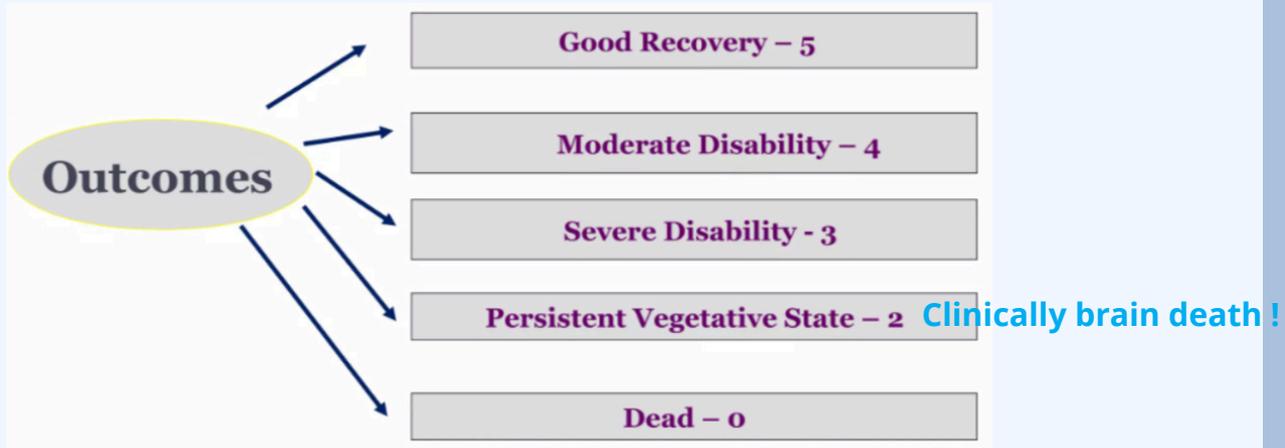
Complication (of head injury)

Early

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

Late

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



« مَا فَاتَ مَاتَ، وَفِي الْأَمَالِ مُتَسَعِّجٌ
وَفُسْحَةُ الْوَقْتِ لِلسَّاعِينَ لَمْ تَزَلِ »

