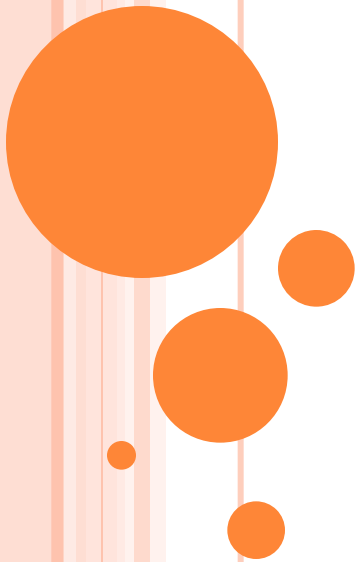


REGIONAL INJURIES

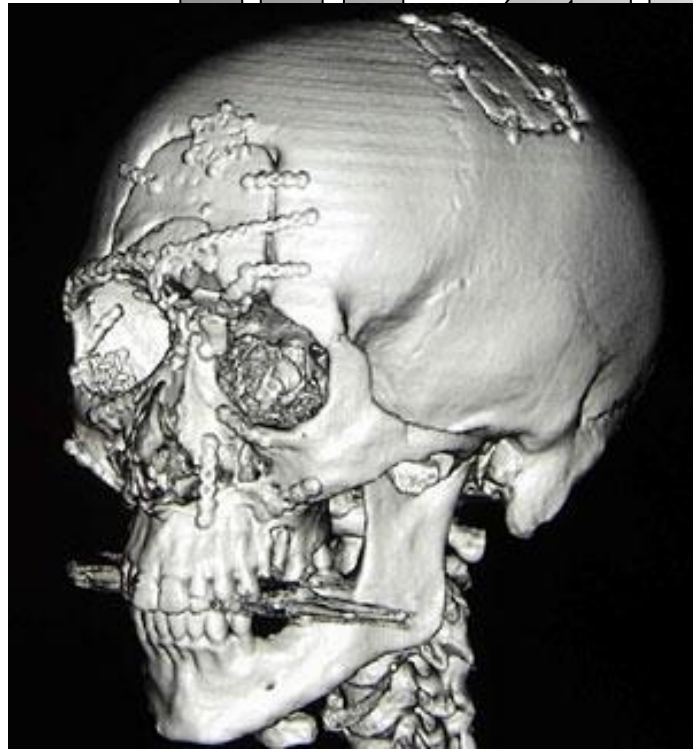


TOPICS TO BE COVERED ARE---

- Head injury
- Spinal cord injuries
- Road traffic injuries
- Injuries to internal organs
- Railway injuries



Head Injuries





Definition:

It is a morbid state, resulting from gross or subtle structural changes in the scalp, skull, and the contents of the skull, produced by mechanical forces.

Note: The extent and the degree of the injury to the skull and its contents is not necessarily proportional to the amount of force applied



Head Injuries involve
the following structures

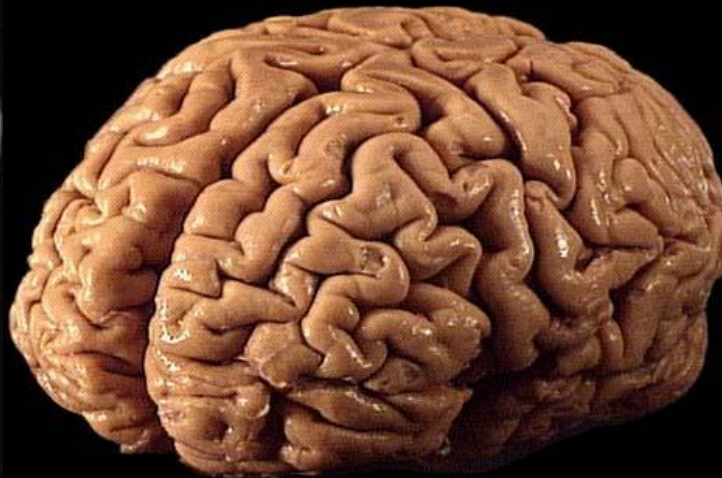
SCALP



SKULL



BRAIN



FACE



▣ **HEAD INJURY**

Anatomical review

Sagittal section of skull illustrated;

- a - Skull
 - * External osseous plate
 - * Membranous osseous tissue
 - * Internal osseous plate

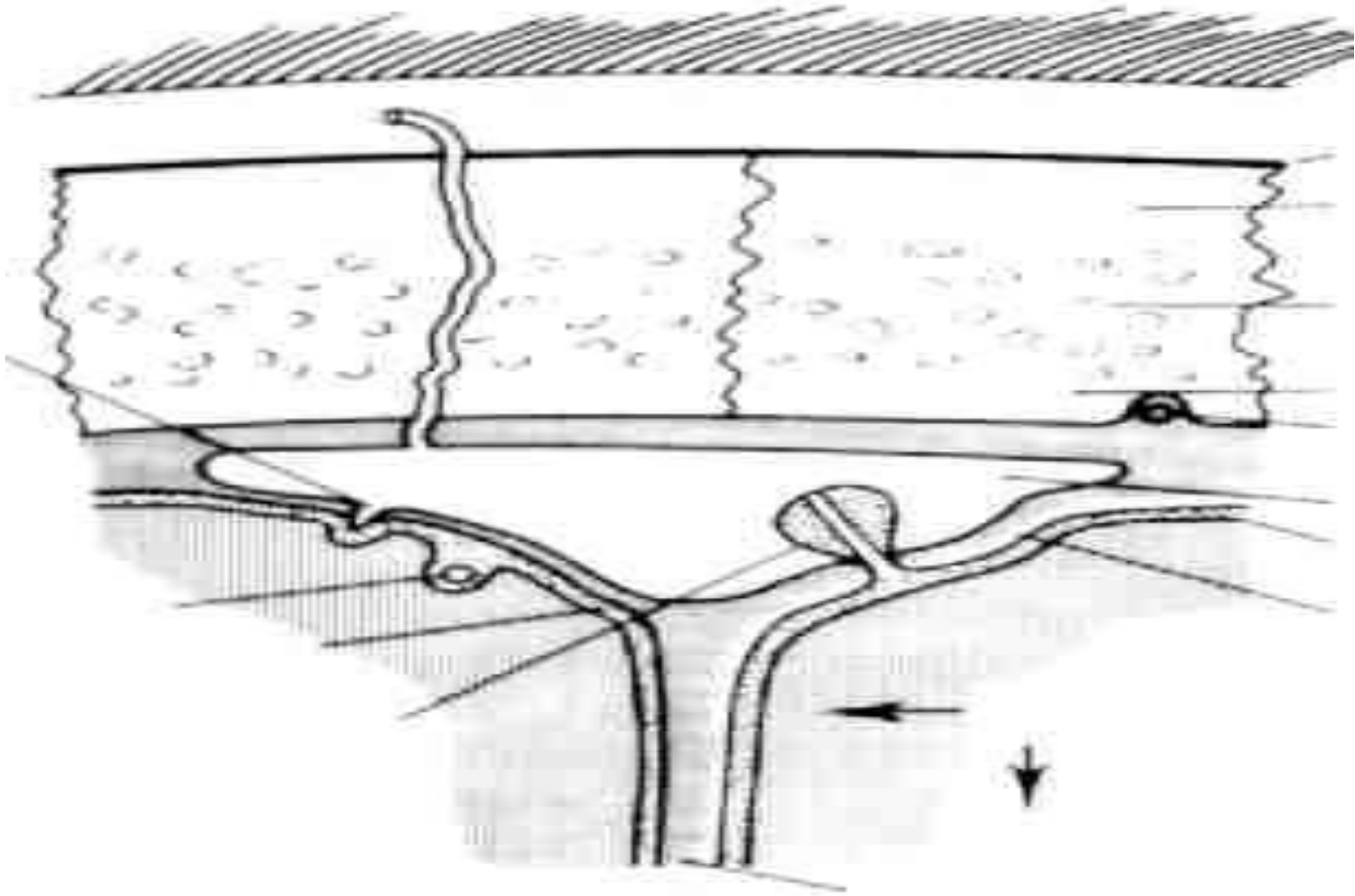
b – Meninges

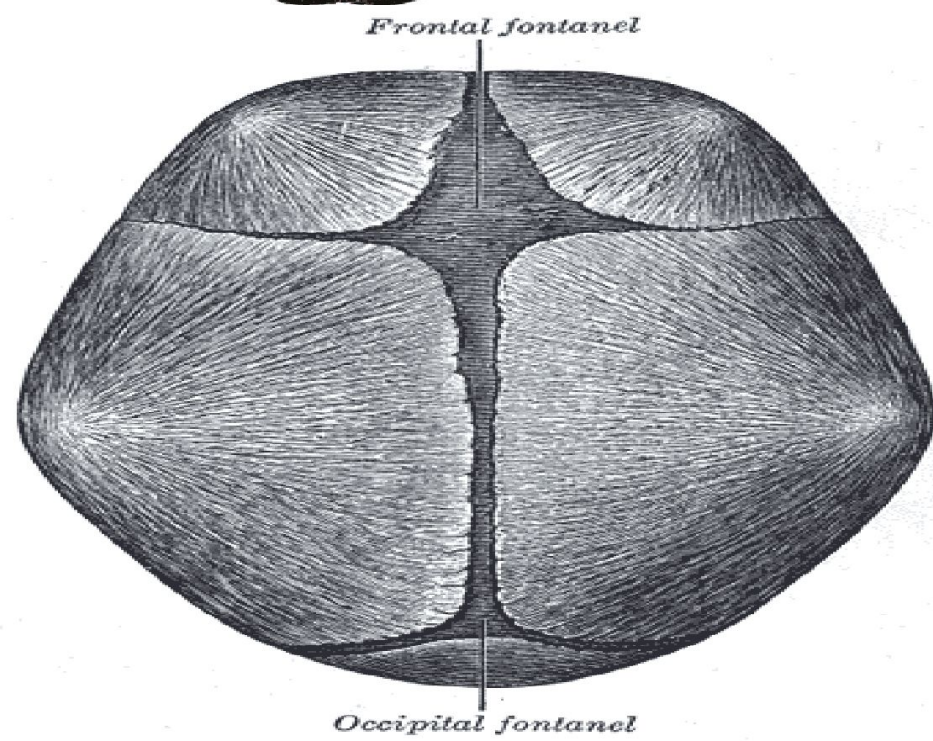
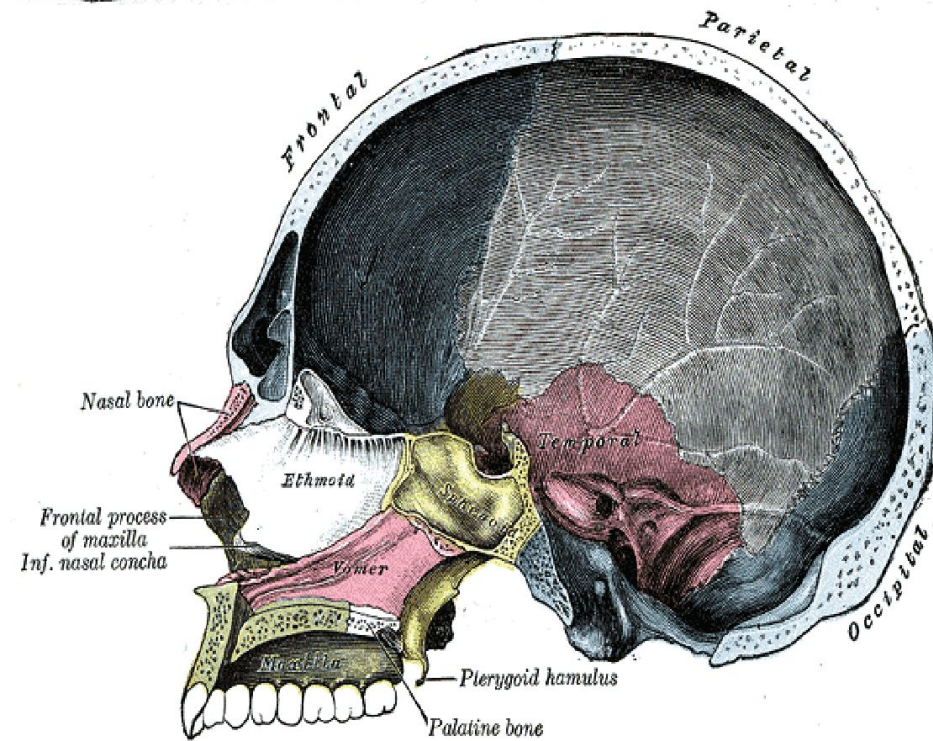
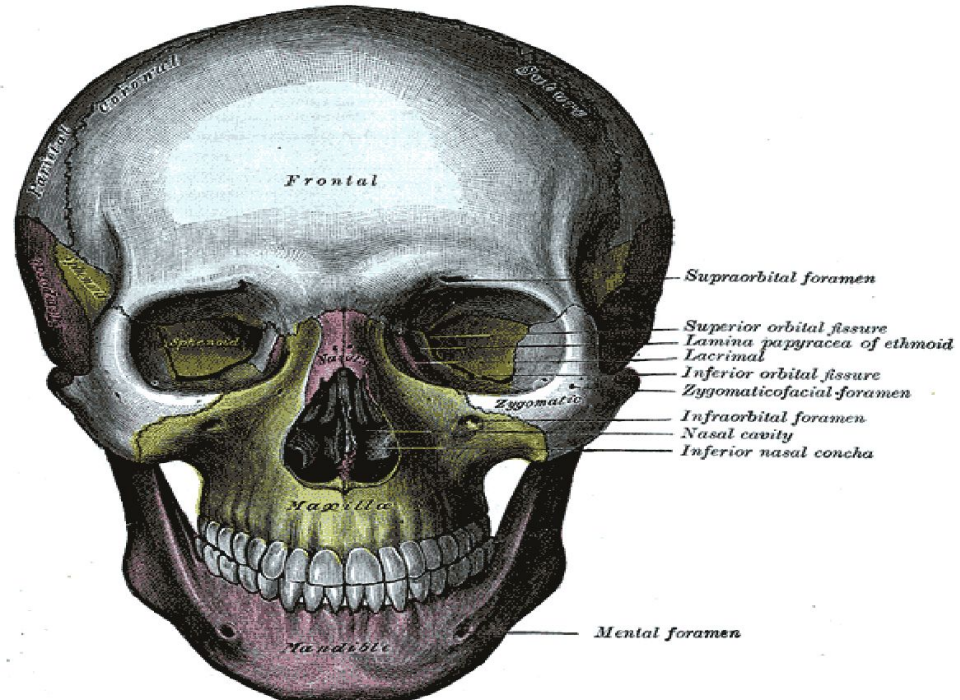
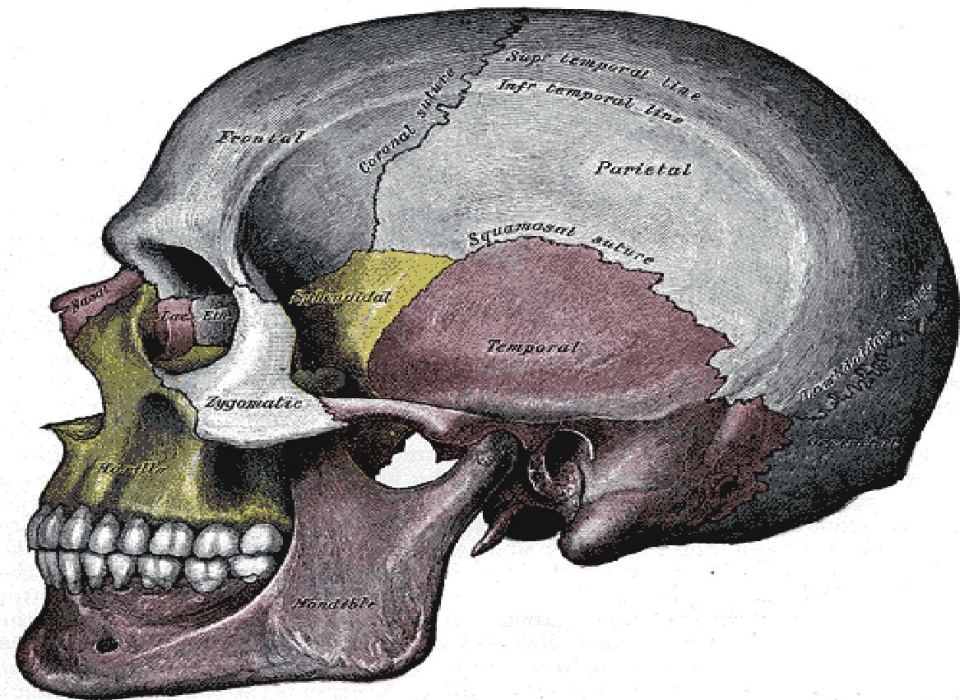
- * Dura mater
- * Arachnoid mater
- * Pia mater

c – Cerebral tissue



□ Microscopic view of all layers





Head injury:

It is a morbid state, resulting from gross or subtle structural changes in the scalp, skull, and the contents of the skull, produced by mechanical forces.

Types of head injury

1. **Closed**-If dura remains intact, irrespective of whether the skull is fractured or not.
2. **Open**-If dura is lacerated or torn, as it is susceptible to infection

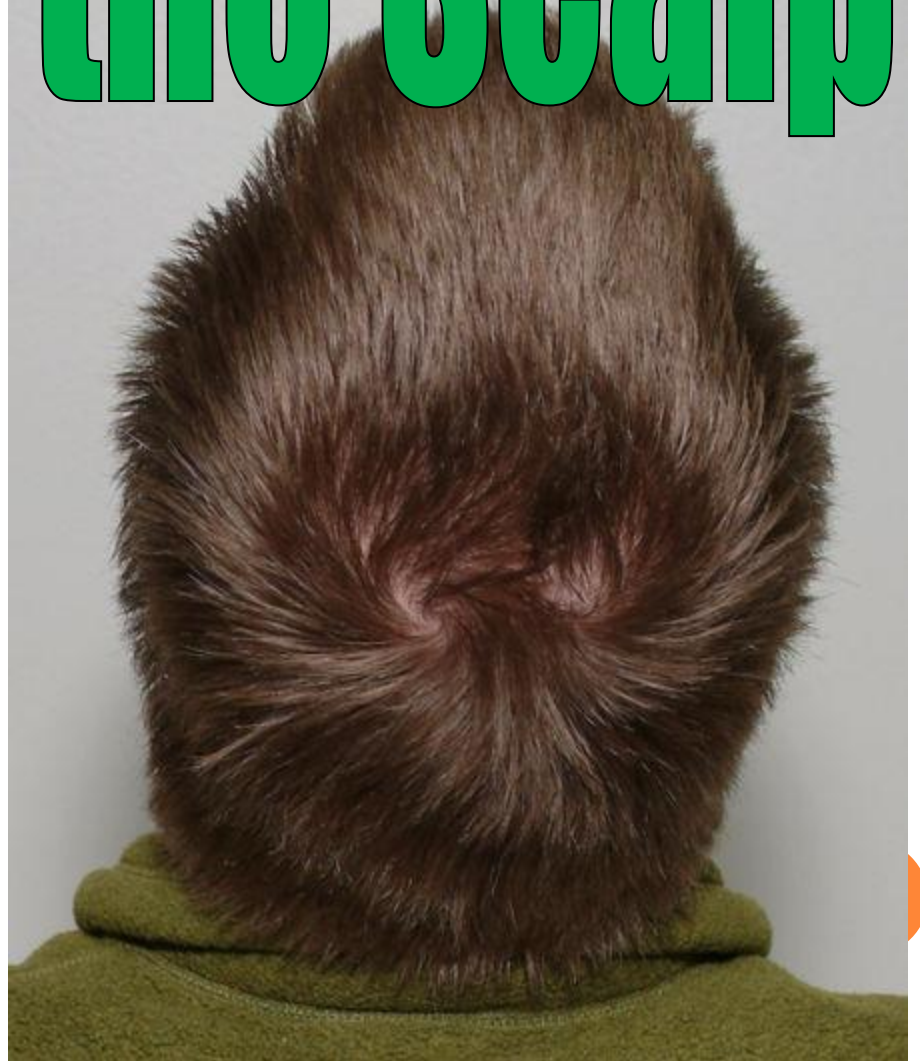


□ **Amount of Cranio-cerebral injury depend upon**

1. Causative agent
2. Velocity of impact
3. Thickness of part of skull under the seat of impact
4. Mobility of head, when struck
5. Degree of violence



Injuries to the Scalp



▣ Scalp injuries

▣ Layers of scalp

1. S: Skin
2. C: Superficial fascia
3. A: Epicranial aponeurosis with occipitofrontalis muscle
4. L: loose areolar tissue
5. P: Pericranium



- The thickness of the scalp is variable, ranging from a few mm to 1cm.
- Most injuries are a result of blunt force, ie, from falls or blows.
- In Scalp- mainly of **2 types**, viz, **contusions** and **lacerations**.



Contusions

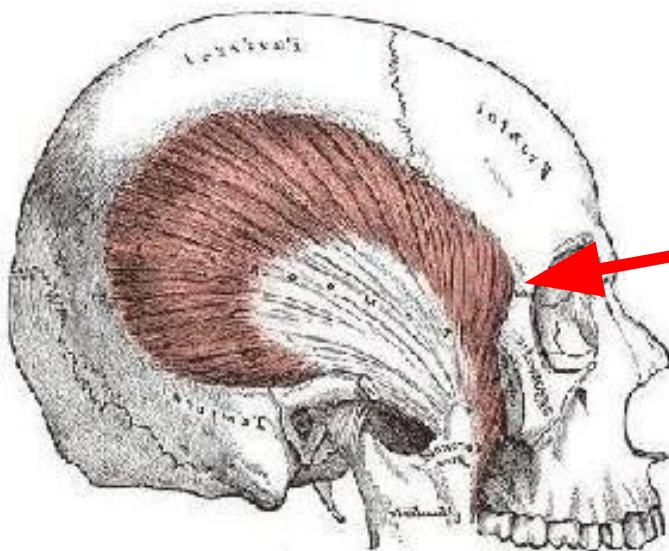
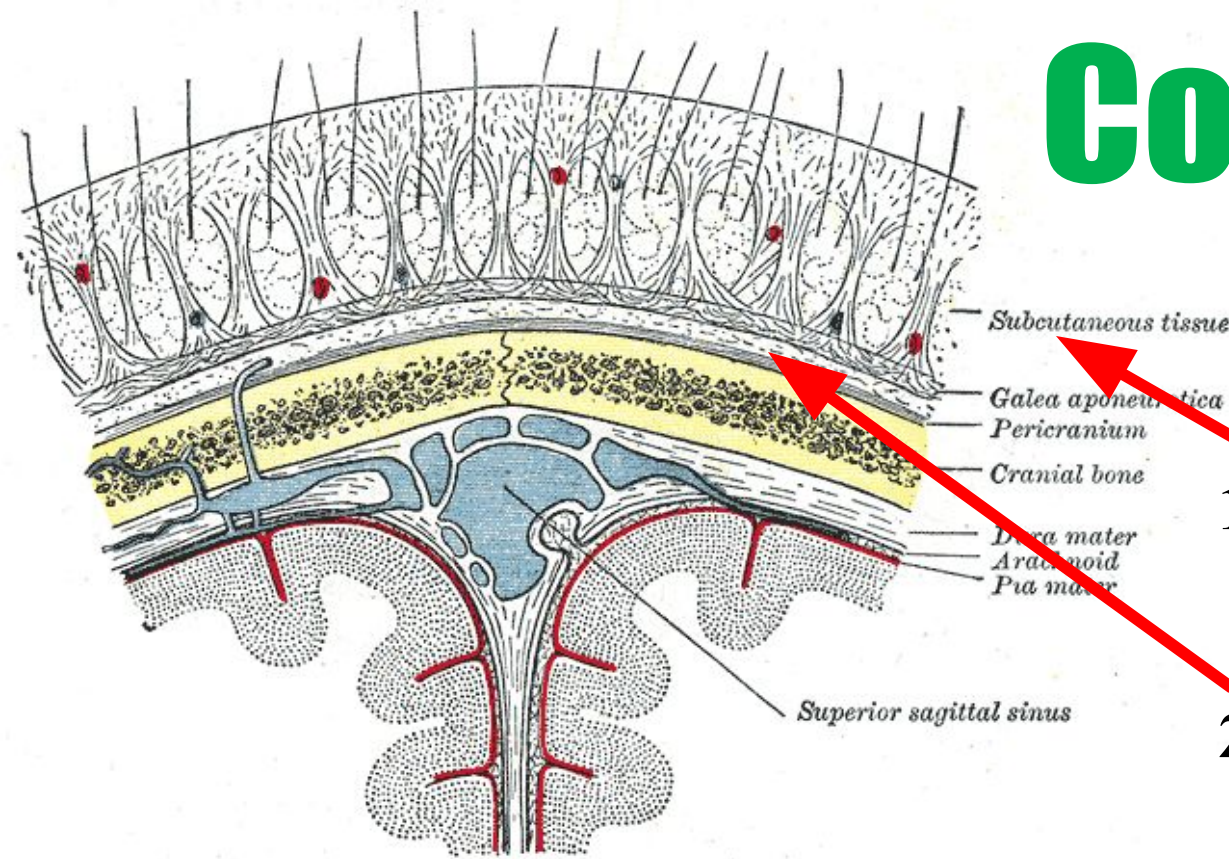


Lacerations

Contusions

Contusions of the scalp occur in 3 regions:

- 1. Superficial fascia**
- 2. Sub-galeal loose connective tissue**
- 3. Temporalis muscle**



Contusions

Contusions of the superficial fascia are localised red swellings, and are limited because of the dense fibro-fatty tissue of the fascia

Localised
contusion



Contusions

Sub-galeal haemorrhages, in the loose connective tissue, are extensive and spread over most of the skull.



Contusions

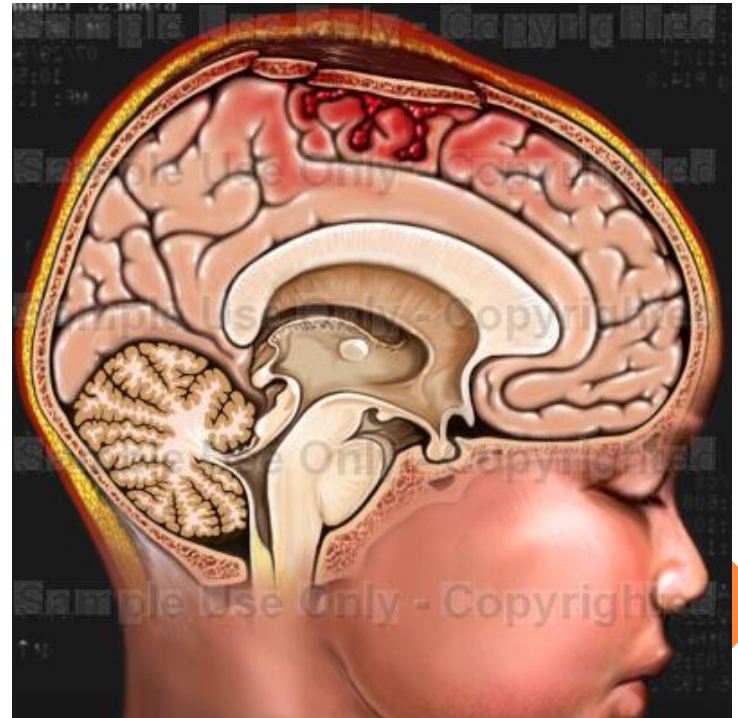
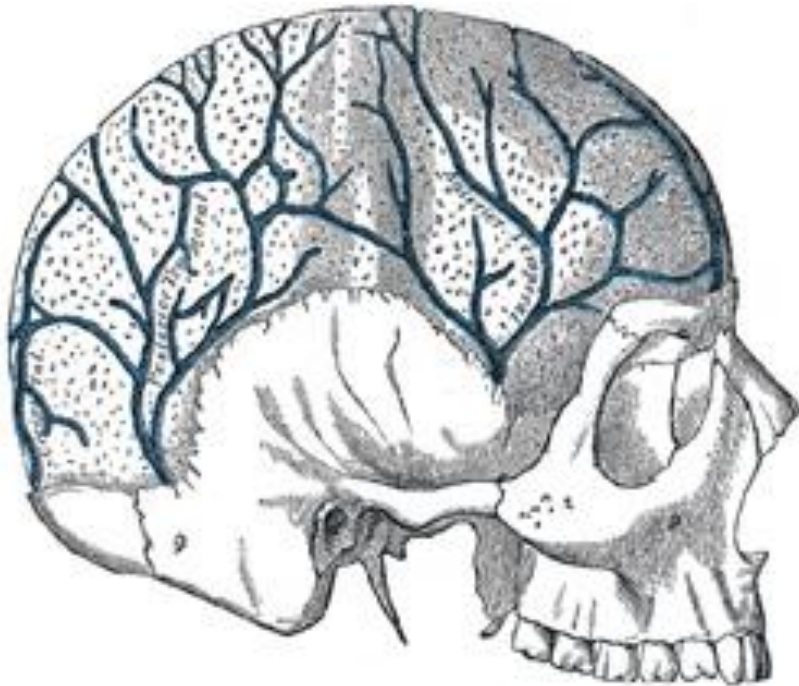
Contusions in the area of the temporalis appear behind the ear.

i.e. Migratory/Ectopic contusion



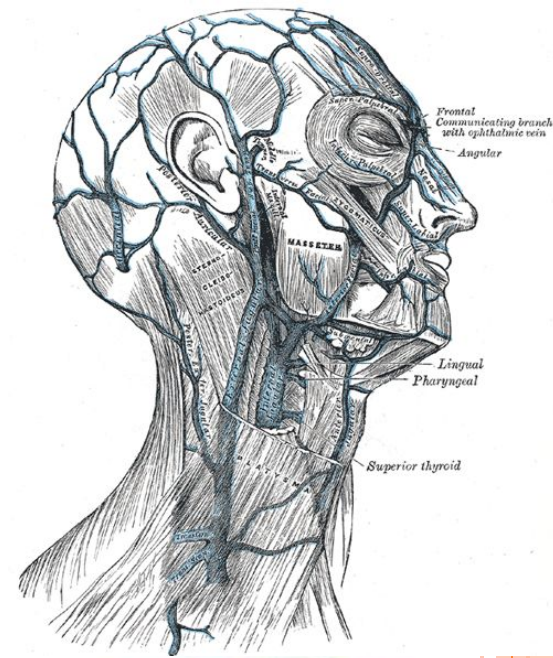
Contusions

When there is a fracture of the vault of the skull, blood extravasates into the scalp tissue from ruptured diploic veins

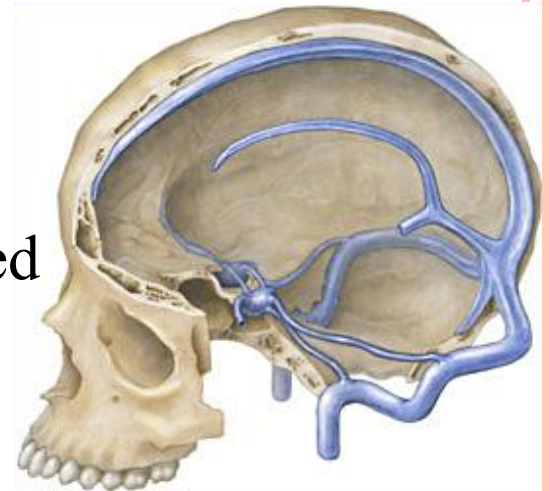


Contusions

The veins of the scalp and face are connected by emissary veins with the cavernous, lateral and parasagittal sinuses; thus, infection of a contusion of the scalp results in thrombophlebitis, which may spread to the dural venous sinuses.



Contusions are frequently accompanied by oedema



Lacerations



Lacerations of the scalp resemble incised wounds.



A direct blow causes a small laceration, while an oblique blow causes an extensive laceration.

Lacerations



Subsequently, there will be considerable bleeding, but blood will not be projected about the scene. If further blows are struck, blood will be projected from the already lacerated scalp. Blood may adhere to the weapon.

Blood will be projected in the direction of the weapon uplift. Blood will be splattered about the crime scene and also on the assailant.



Avulsion of a large area of the scalp can occur due to vehicular accidents.



Scalp injuries can bleed profusely even after death, especially if the head is in a dependent position.



- ❑ Injuries over the scalp more visible if scalp hairs shaven off.
- ❑ Abrasions relatively uncommon due to presence of hair.
- ❑ Superficial contusions appear as localized swelling on palpation due to limitation by fibro-fatty tissue while contusions deep to galea aponeurotica tend to diffuse due to loose aponeurotic tissue.



Intracranial infections common in injuries to scalp

- ❑ Diploic veins lie in spongy tissue between the two tables of skull & communicate, in the interior of skull with meningeal veins & sinuses, and on the exterior of the skull with veins of the pericranium.
- ❑ Emissary veins which pass through the aperture in the skull connect veins of the scalp & face with sagittal, lateral & cavernous sinuses



UNDERSCALP HAEMATOMA



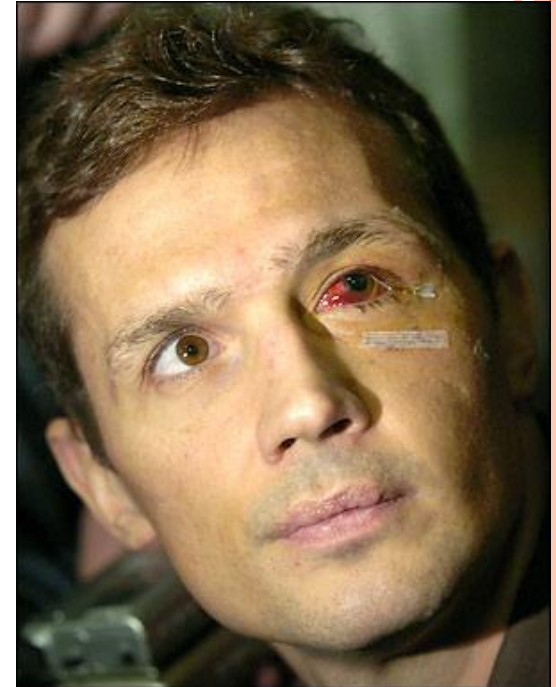
Injuries to the Face



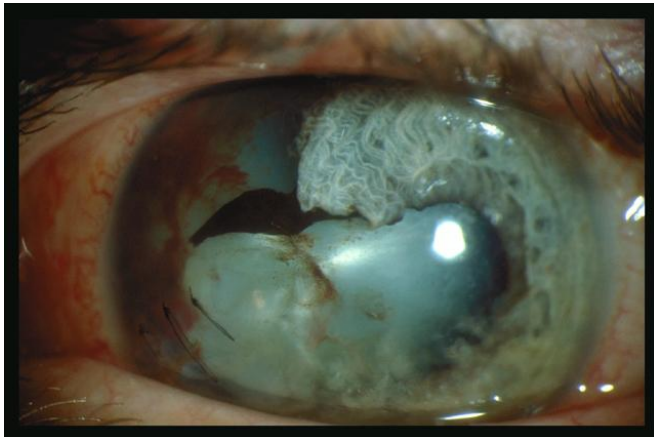
Eye Injuries

Corneal/iris/lens damage

Vitreous haemorrhage



Traumatic cataract



Gouging of the eyes



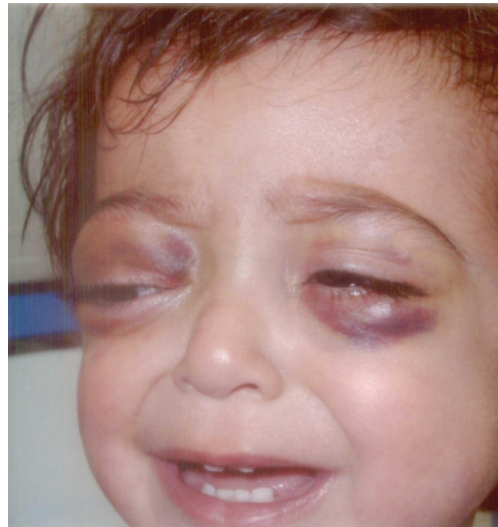
Black eye

The causes of a black eye are:

1. A direct blow to the front of the orbits, bruising the eye-lids
2. Injury to the forehead, with blood tracking down, under the scalp.
3. Fracture to the base of the skull in the anterior fossa, with blood leaking through the fractured orbital plates.



Direct blow to the orbit



Fracture of the base of the skull – racoon's eyes



Injury to the forehead



Nose bleed

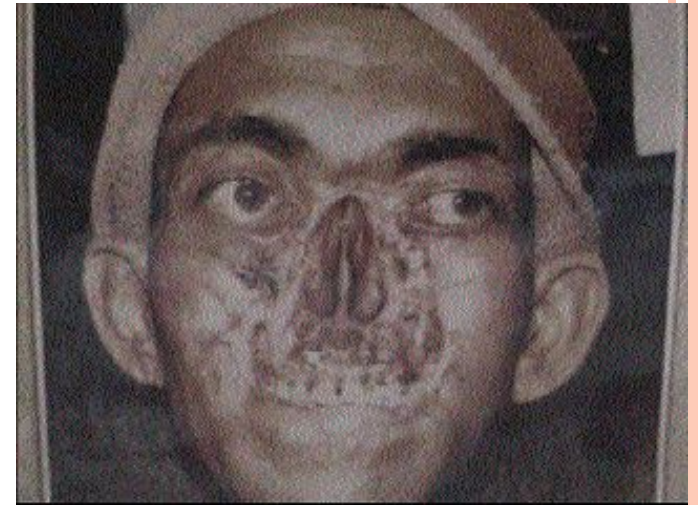


Laceration



Broken nose

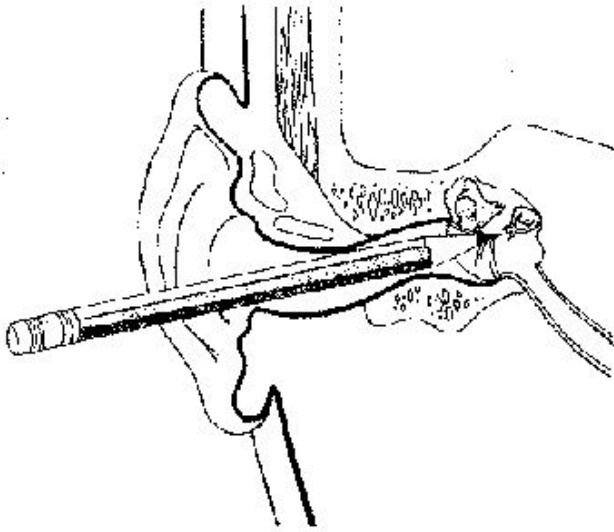
Nose Injuries



Nose ripped-off

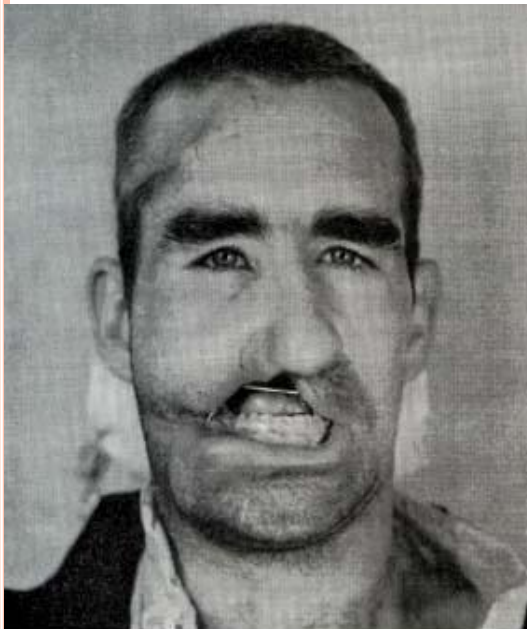
Ear Injuries

Ear injuries involve bruising and laceration of the external ear, as well as damage to the tympanum, middle ear and internal ear.



Facial Bone Injuries

- Blunt force can fracture the nasal and ethmoid bones, with radiating fractures into the supraorbital plates.
- Blunt force can fracture the maxilla and malar bones.
- The mandible can be fractured by blunt force. The condyles of the mandible can be driven into the base of the skull; sometimes,
- Pulping of face can occur with heavy force.



Injury to Teeth and Lips

A blow to the mouth can cause the teeth to break and contusion or laceration of the lips.



Injuries of the Skull





The outer table is twice the thickness of the inner table.

The inner table is more brittle than the outer table.

The thickness of the frontal and parietal bones is 6 to 10mm.

The temporal bone is the thinnest, at 4mm.

Causes of Skull fractures:

Fractures may be caused by Direct or Indirect violence.

(A) *Direct violence:*

1. Compression of the skull, as may be the case with mid-wifery forceps or when the head is crushed in vehicular accidents.
2. An object in motion striking the head, eg: bullets, bricks, masonry, machinery, dagger, etc.
3. Head in motion, striking an object, as in a fall, or in traffic accidents.

(B) *Indirect violence:*

Indirect violence involves a fall on the feet or the buttocks.



Mechanism of Fracture of the Skull:

A) *Fracture due to local deformation:*

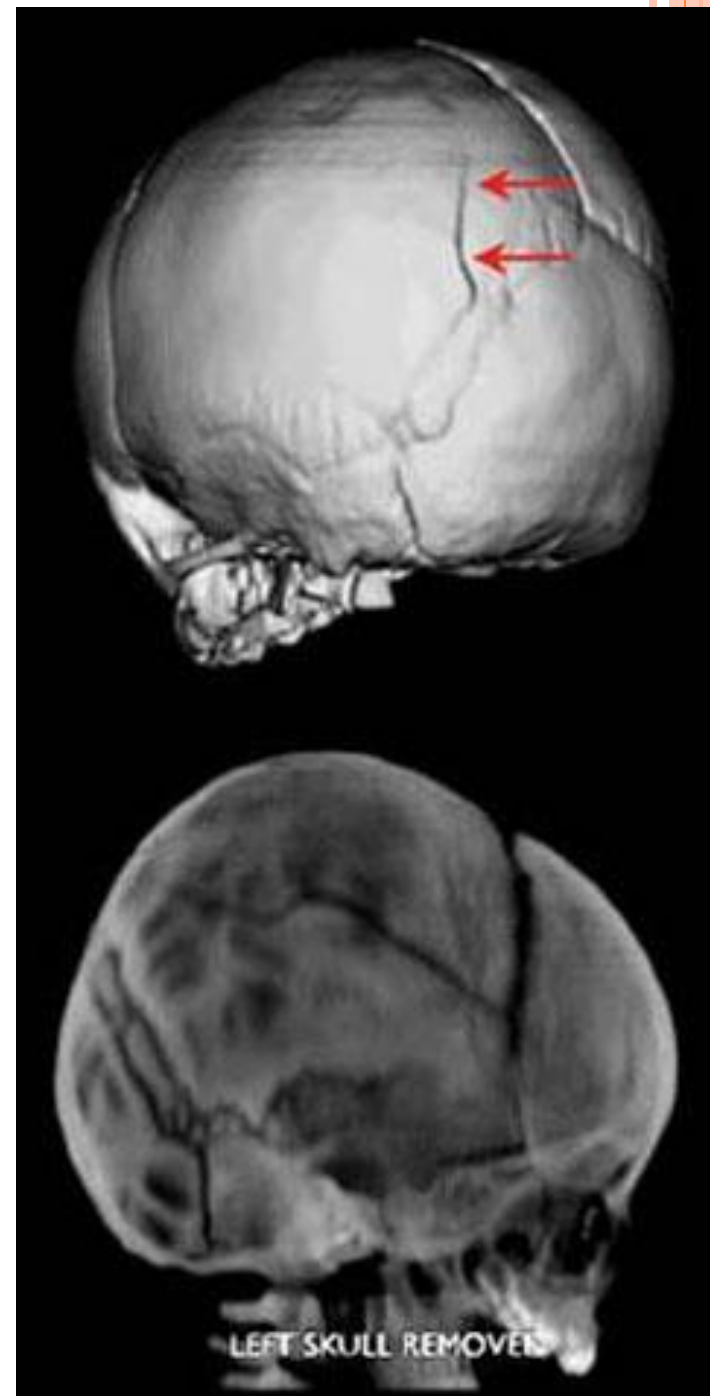
If a mass strikes the head at a sufficiently high speed, it produces a cone shaped indentation. At the apex, the inner table is stretched and thus fractures first. With continuing force, the outer table fractures, and radial fracture lines arise from the central point. At the periphery, the outer table is stretched, and thus fractures, circularly bounding the indentation.



Mechanism of Fracture of the Skull:

(B) Fracture due to general deformation:

If the skull is compressed, there is shortening of its diameter along the line of pressure, while areas of the skull, distant from the area of application of pressure bulge. As such, these areas get stretched and rupture.



FRACTURE OF SKULL

Fracture of vault

1. Fissured fracture
2. Depressed fracture
3. Comminuted fracture
4. Pond's fracture
5. Gutter fracture
6. Perforating fracture
7. Diastatic/Sutural
8. Cut fracture
9. Heat fracture
10. Crush fracture
11. Contre-coup fracture

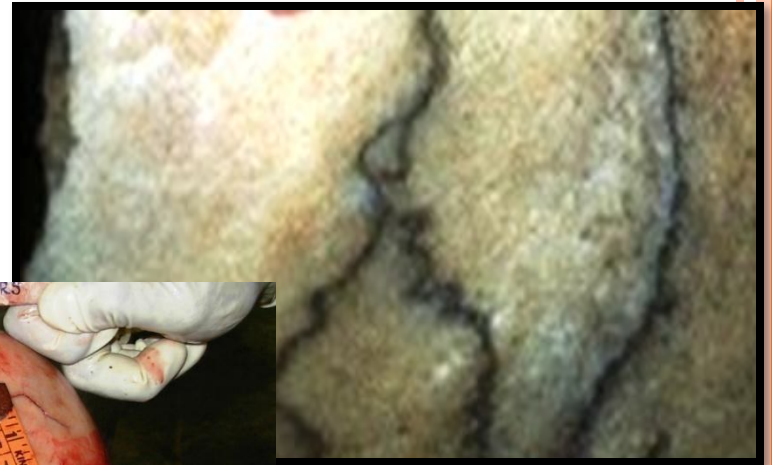
Fracture of Base

1. Longitudinal fracture
2. Transverse (Hinge Fracture)
3. Ring Fracture

Types of hinge fracture-
type I,
type II,
type III

1. Fissured Fracture

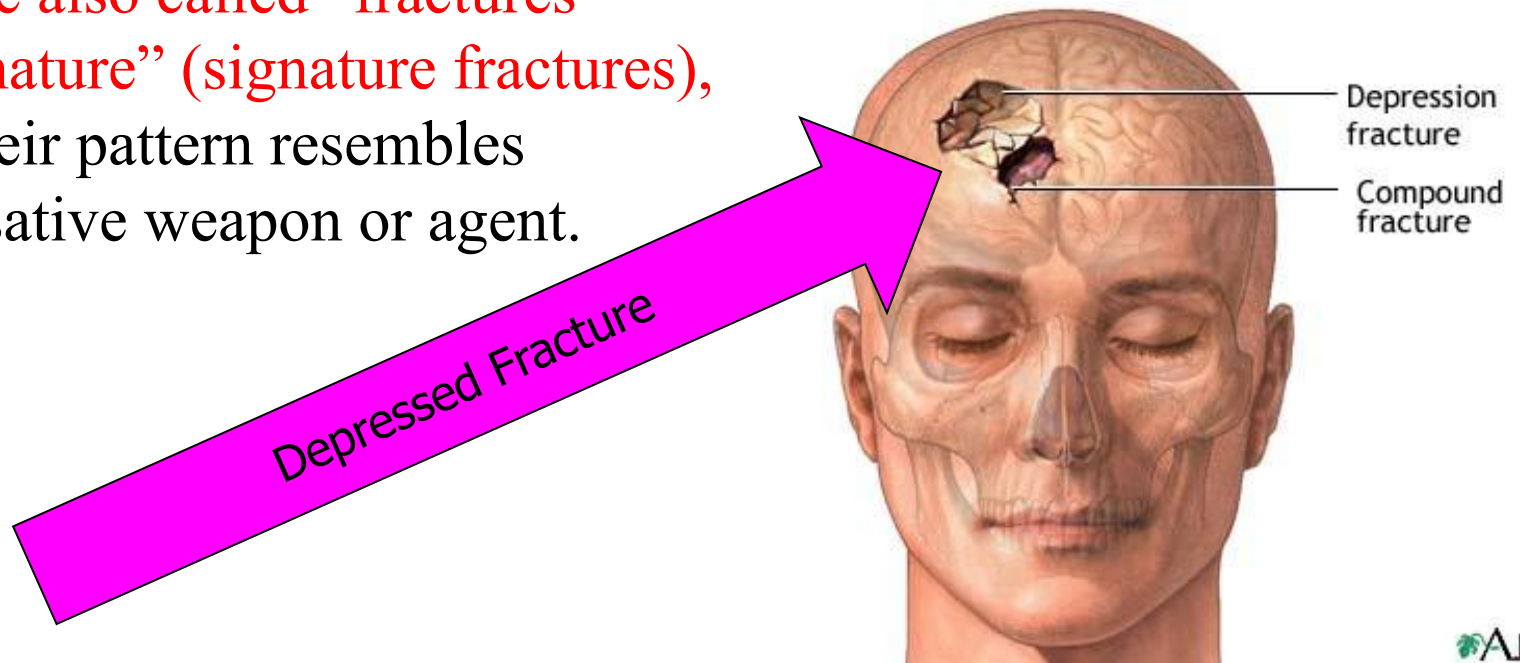
- They result from general deformation of the skull.
- They are caused by the head striking a broad resisting surface, or by an object with a broad striking surface, or indirectly, by a fall on the feet or buttocks.
- They are linear fractures.
- They involve the whole thickness of the skull, the outer table or the inner table.
- Majority of skull fractures are fissured Fractures.

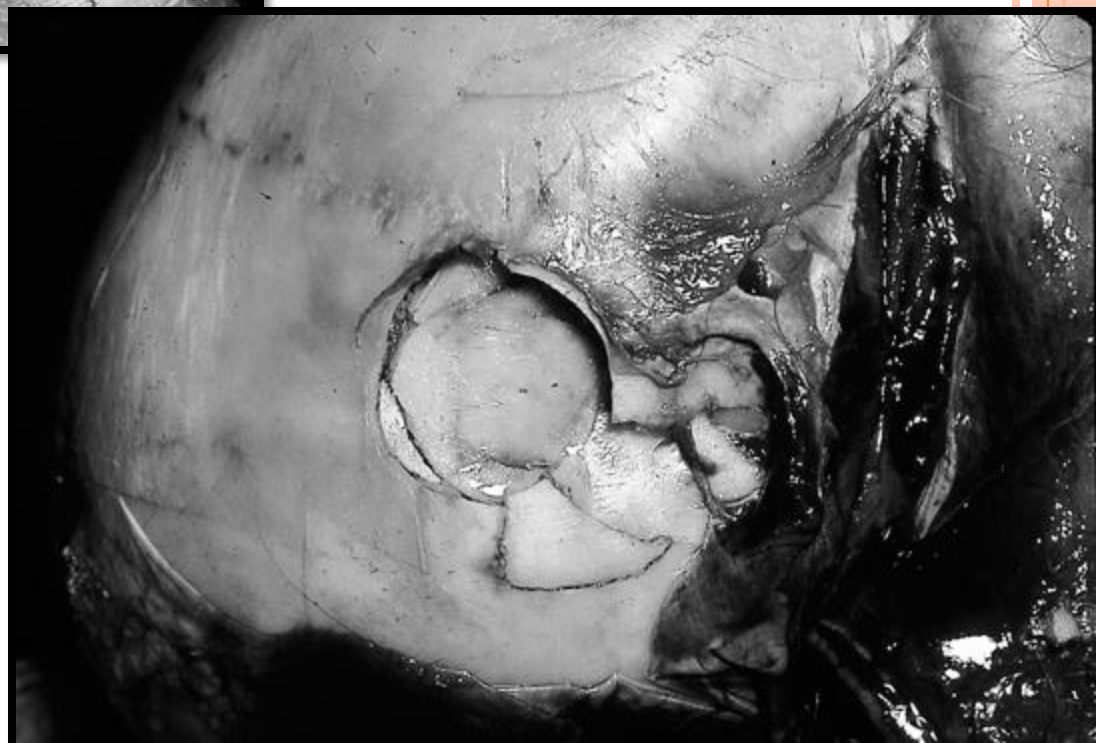


Fissured Fracture

2. Depressed fracture

- They are caused by local deformation of the skull.
- In these fractures, the fractured bone is driven inwards into the skull cavity.
- The outer table is driven into the diploe, while the inner table irregularly fractures, and may be comminuted.
- They are also called “fractures à la signature” (signature fractures), since their pattern resembles the causative weapon or agent.





3. Comminuted Fracture

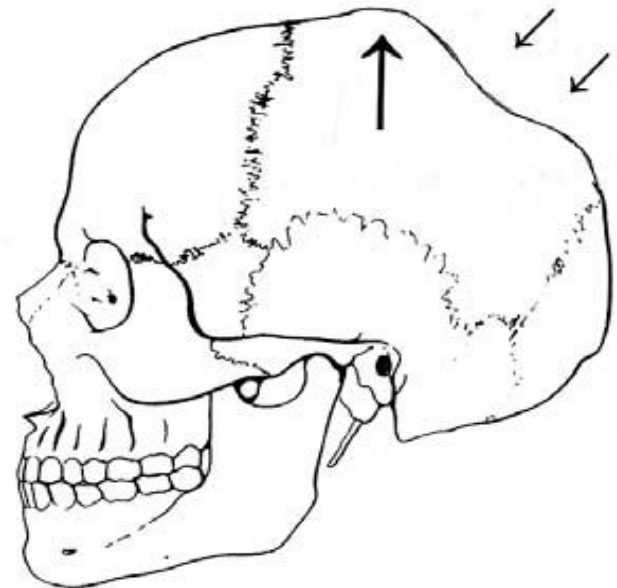
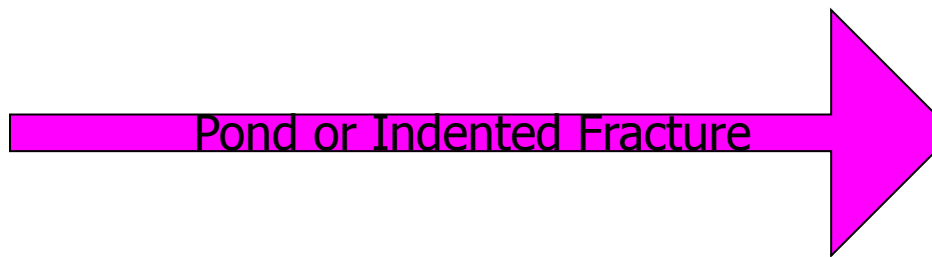
- Fracture is said to be comminuted when **two or more intersecting lines of fracture divide the bone into three or more fragments**.
- They may be caused by vehicular accidents, fall from a height on a hard surface, or blows from weapons with broad striking surfaces.
- They may be complications of fissured or depressed fractures.
- When there is no displacement of the fragments, the fracture has a spider's web appearance.
- When the force is great, fragments may be displaced into the brain or may be lost.

Comminuted Fracture



4. Pond or Indented Fractures

- These occur only in the skull of infants.
- They form simple dents in the skull, which result from obstetric forcep blades, a blow from a blunt object, or forcible impact against a protruding object.
- The inner table is not fractured, but, fissured fractures may occur in the outer table around the periphery of the dent.



5. Gutter Fractures

If weapon strikes the skull tangentially, outer table of skull gets fractured causing deformity in the form of gutter
e.g. glancing bullet injury.



6. Perforating Fractures

- These are caused by firearms or by sharp pointed weapons, like daggers or knives.
- The weapon passes through both the tables of the skull, leaving, more or less, a clean-cut opening, the size and shape of which corresponds to the cross-section of the weapon used.

Perforating Fracture



7. Diastatic or Sutural Fractures

- They involve separation of the sutures of the skull.
- They result from blows to the skull with a blunt weapon.
- They occur mainly in young persons.
- They may occur alone or may be associated with other fractures.

Diastatic or Sutural Fracture



8. Heat fracture-

Usually it occurs at sutural site due to production of gases inside the cranial cavity in cases of extensive burns.

9. Crush fracture-

Here, crushing of skull bone into multiple pieces with distortion of skull & face.

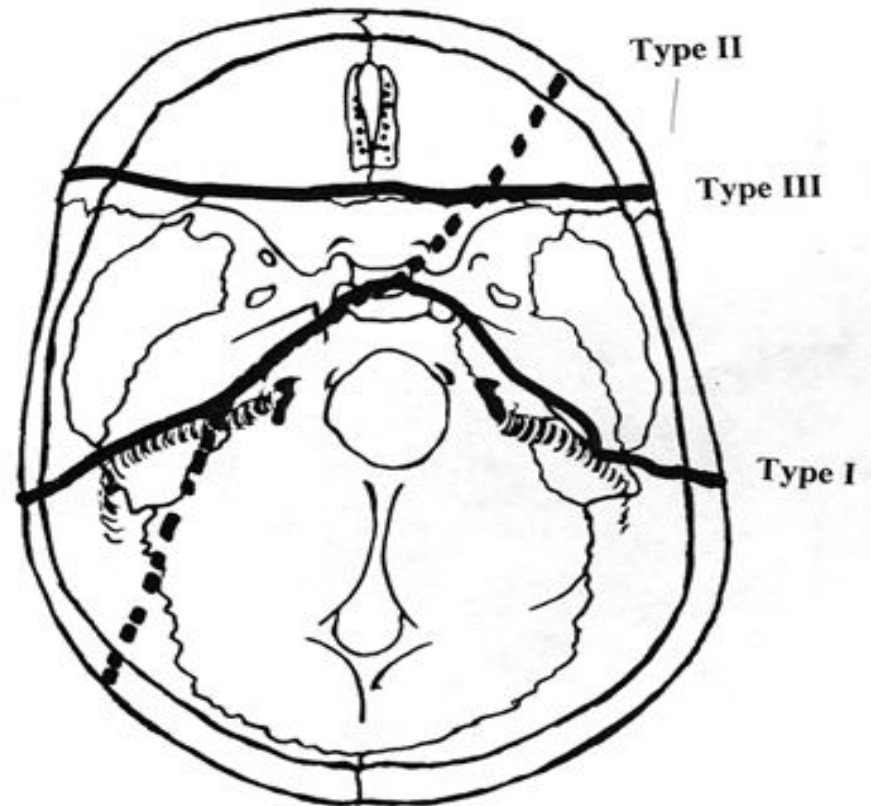
10. Contre-coup fracture-

Fracture occurs in the direction of force & at the thin & less resistant part of bone



FRACTURE OF BASE

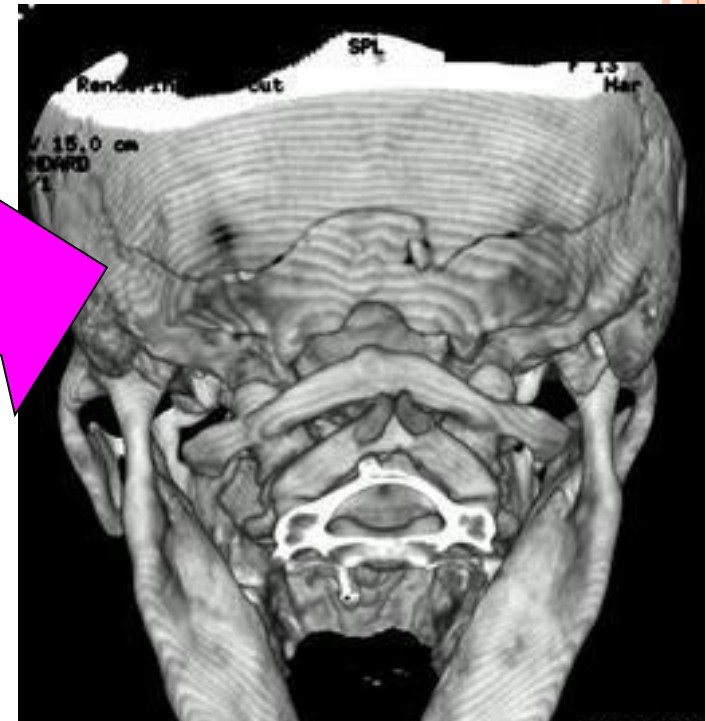
- LONGITUDINAL
- TRANSVERSE (HINGE FRACTURE)
- TYPES OF HINGE FRACTURE- TYPE I,
TYPE II,
TYPE III
- RING FRACTURE



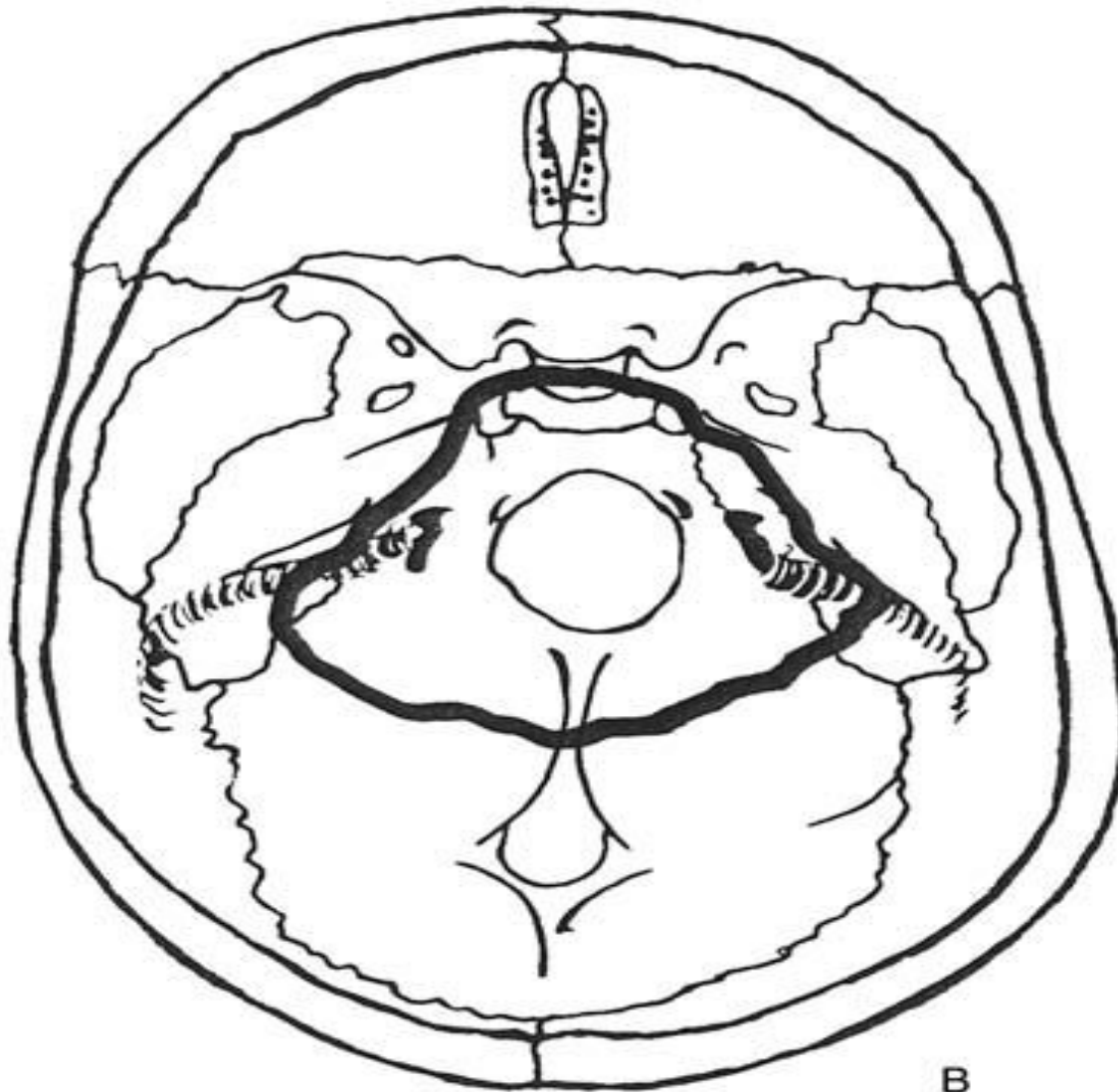
Ring or Foramen Fractures

- It is a fissured fracture which encircles the skull, surrounding the foramen magnum.
- The fracture usually runs about 3 to 5 cm around the foramen, along the back and sides of the skull, and passes to the front through the middle ear and nose.
- They are caused as a result of a fall from a height, on the head or buttocks.
- They are very rare.

Ring or Foramen Fracture



Ring fracture



Features

- ❑ **AM fracture-** Extravasation of blood in fractured edges & surrounding tissue.
 - ❑ **Base of skull** more susceptible to fracture due to irregular shape & several foramina passing through it.
 - ❑ Fracture of **cribriform plate** of ethmoid
 - Bleeding through nostrils
 - CSF rhinorrhoea
 - ❑ Fracture of **petrous part** of temporal bone:
 - Bleeding through ears
 - CSF otorrhoea
 - ❑ Fracture of **sphenoid**
 - Bleeding through mouth
 - ❑ Fracture of **posterior cranial fossa**
 - escape of blood & CSF into tissues of back of nape of neck.
- 

COMPLICATION OF FRACTURES:

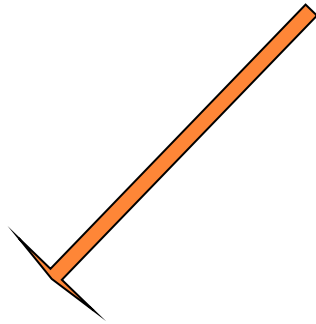
- 1) Injuries to meninges & brain.
- 2) Injury to cranial nerves due to stretching.
- 3) Entry of air into the ventricles from air sinuses leading to pneumatocoele.
- 4) Intracranial haemorrhages due to tearing of vessels.
- 5) Infection



Injuries of the Brain and Meninges



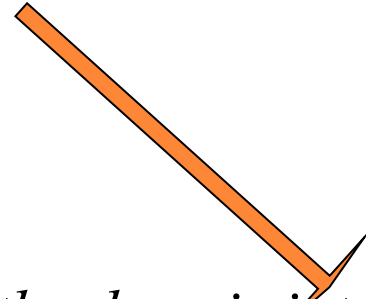
Intracerebral Lesions



If the dura is lacerated....

Open Injury

- The dura is lacerated
- The brain is lacerated.
- It is caused by a penetrating object like a bullet, or by a fragment of the skull.
- The brain is open to infection.



If the dura is intact....

Closed injury

- The dura is intact; the skull may or may not be fractured.
- The brain is damaged.
- It is caused by blunt force, due to a non-penetrating object, or due to a fall, or the head striking a firm surface.
- The brain is closed to infection



TRAUMATIC BRAIN AND MENINGEAL INJURIES

1. Contusion
2. Laceration
3. Perforating injury
4. Intracranial Haemorrhages
 - Epidural Haemorrhage
 - Subdural Haemorrhage
 - Subarachnoid Haemorrhage
 - Intra-cerebral Haemorrhage
 - Intra-ventricular Haemorrhage
- 5) Cerebral Concussion
- 6) Cerebral Oedema
- 7) Cerebral Compression
- 8) Cerebral Irritation



Brain injury

- The forces transmitted from the skull to the brain surface act chiefly on the surface of brain. These forces not evenly applied on brain surface but maximally developed over those regions of brain which are in close apposition to bony projection or to dural septa.

1. Coup injury: (coup: blow)

A Coup Injury is defined as an injury which develops directly below the area of impact



BRAIN INJURY

2. Contre-coup injury: (contre : opposite)

A Contre-coup Injury is defined as an injury which develops on the surface of the brain, opposite to the area of impact.

e.g. blow over occipital region of skull causes contusion at frontal pole of brain.

- Contre-coup injury more dangerous than coup when both are present.

3. Intermediate coup contusion:

Situated between coup & contre-coup injury.



Mechanism

- An impact on **stationary** head causes skull to move immediately in the direction of force, but the brain lags behind for a brief period. The skull hits the brain at the site of impact leading to development of **coup injury**. This type of coup injury referred as **‘acceleration injury.’**
- At the same time, vacuum is produced at the opposite site by a space created between static brain & forward displaced skull. This vacuum exerts **“suction effect”** pulling the brain into that space to hit against the skull bone there & thus producing injury to that part of brain leading to **contre-coup** injury formation.



- When the **moving** head strikes against stationary object, the skull is suddenly brought to stop by the impact, but the brain continues to move forward for a brief period, thereby hitting against the skull. This type of **coup injury is called 'deceleration injury'**.

- **Shear strain injury:**

When head in motion strike by a blow, a rotational movement imparted to the skull causing the brain to slide against rough projections inside the skull.

- Shear strain injury due to relative twist of :
 - Skull over the meninges
 - Meninges over the brain
 - Brain over the brain



CLASSIFICATION

Traumatic brain damage

- **Cerebral contusion:**

Usually wedge shaped & seen over cortical region.

- **Cerebral laceration:**

Deep laceration heals with forming glial cysts filled with CSF known as 'traumatic porencephalic cysts'.



CEREBRAL CONCUSSION (COMMOTIO CEREBRI) OR 'STUNNING'

- ❑ **Definition:** A concussion is a temporary state of unconsciousness, due to partial or complete paralysis of brain function, as a result of head injury.
- ❑ It is characterised by rapid onset after injury, spontaneous recovery, and usually, amnesia
- ❑ Patient become unconscious & recovery may be complete or may be followed by post concussional syndrome characterized by headache, dizziness, insomnia & mental irritability.

Recovery from concussion followed by

1. Retrograde amnesia

- Unable to recollect the events at the time of incident & afterwards.

2. Post traumatic automatism

Here, person may speak or act in an apparently purposeful manner but has no recollection about it afterwards.

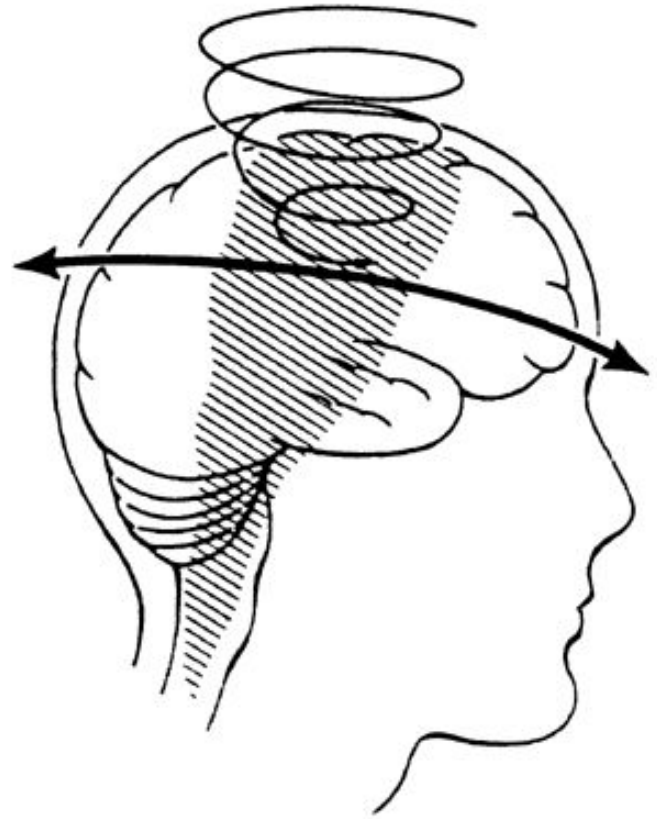
- Grossly: no structural damage, sometimes petechial haemorrhages seen.

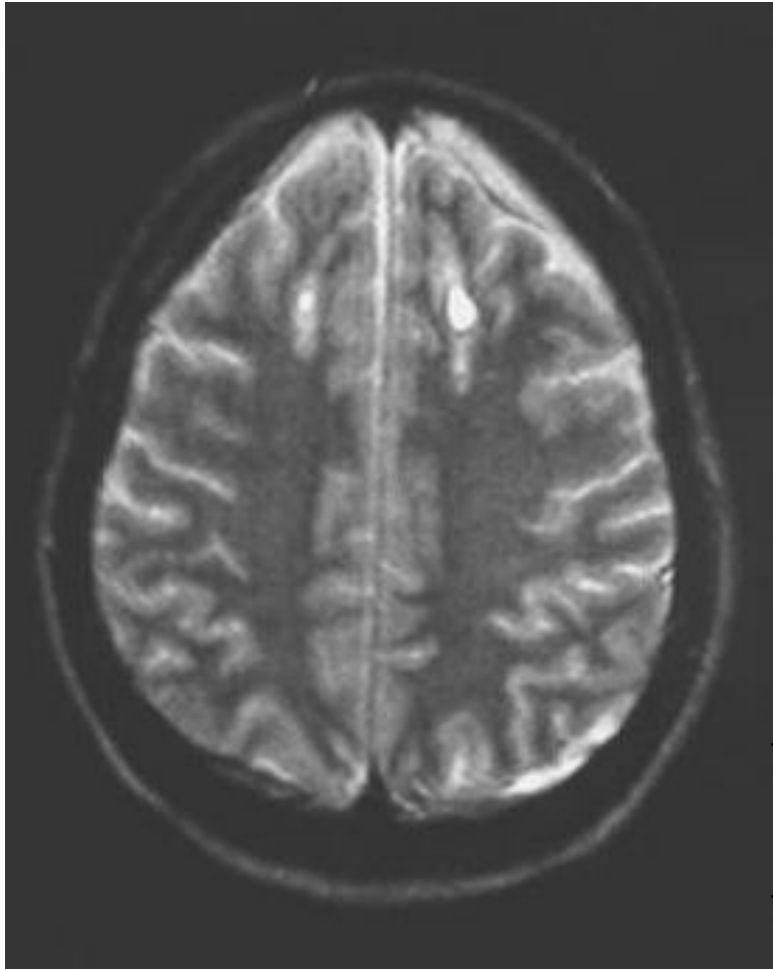


Diffuse Axonal Injury

Definition:

Diffuse Axonal Injury is a clinical condition characterised by diffuse injury to the axons of the brain, immediate loss of consciousness, and coma lasting more than 6 hours.



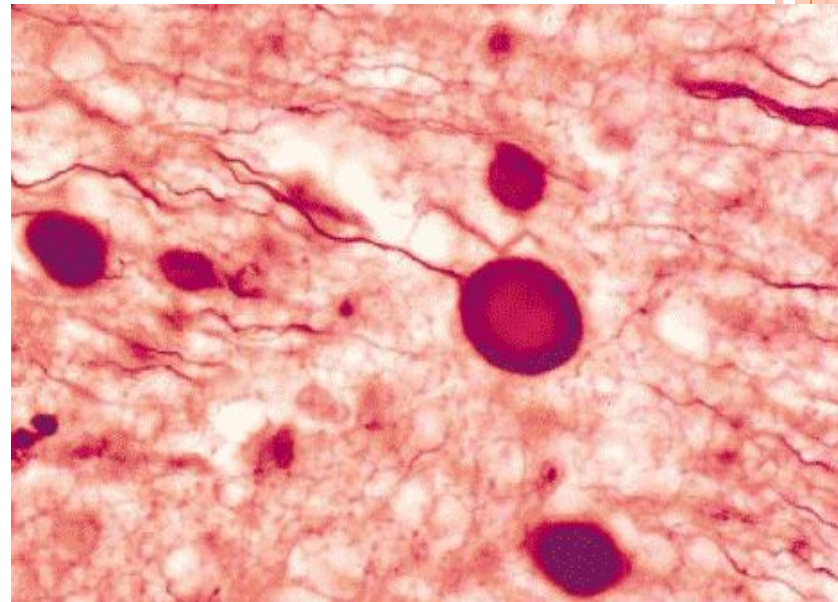
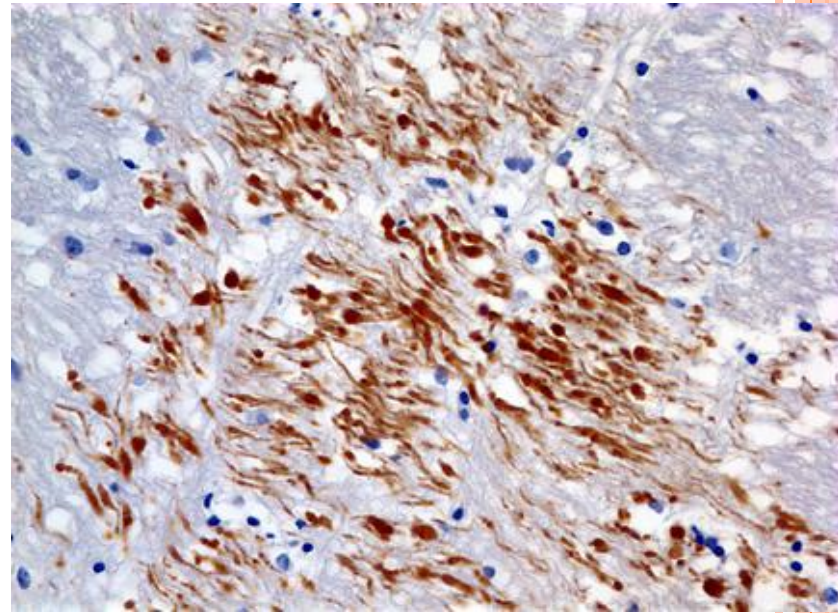


- In mild DAI, there is coma for 6 to 24 hours.
 - In moderate DAI, there is coma for more than 24 hours, but, there are no signs of brain stem dysfunction.
 - In severe DAI, there is coma for more than 24 hours, with brain stem signs.
-
- ❖ It occurs due to vehicle accidents in 90% of the cases.
 - ❖ It occurs due to assault in 10 % of cases.

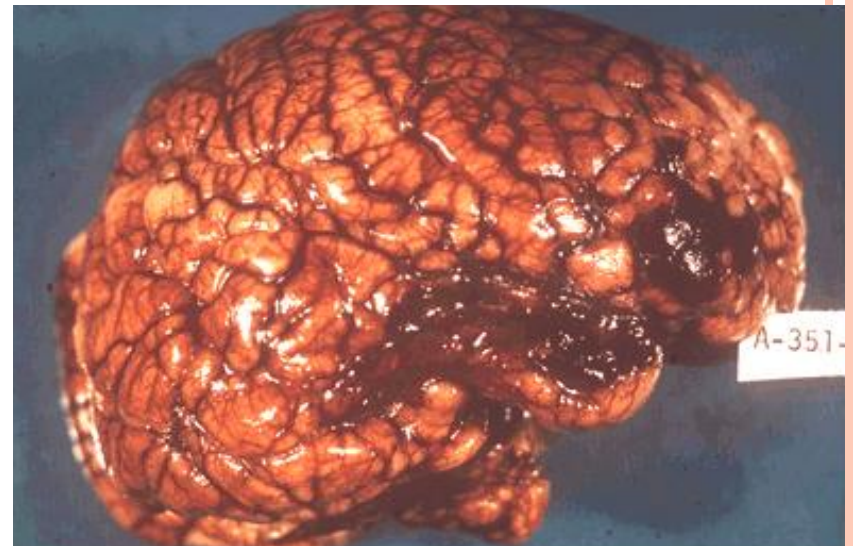
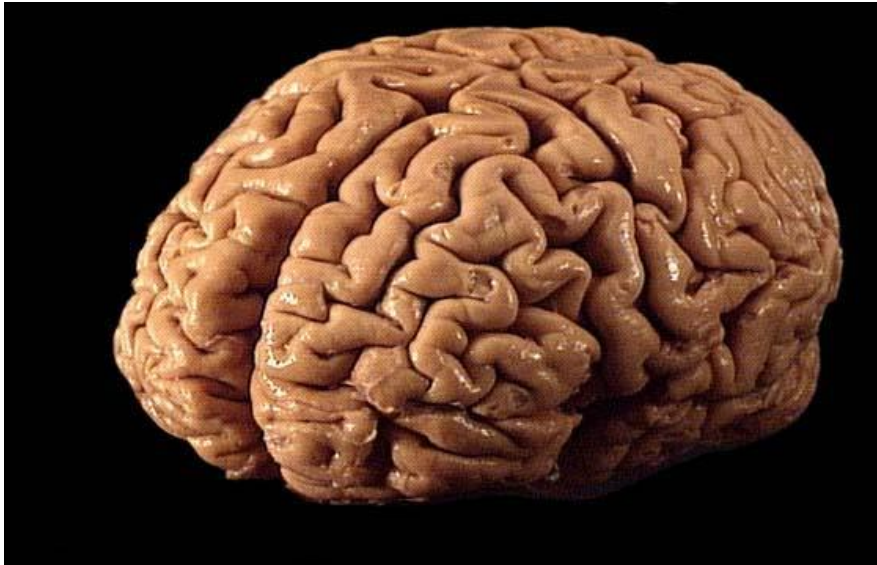
Diffuse Axonal Injury

Features:

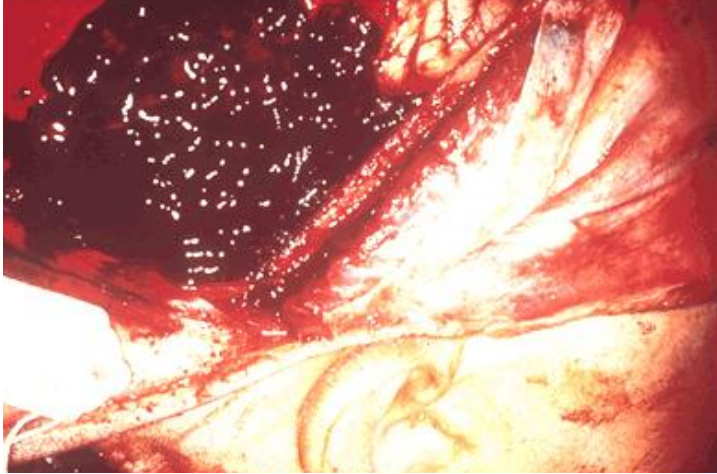
- ❖ Autopsies may not show any change.
- ❖ Petechial haemorrhages may be seen in the cortex at the junction of white and grey matter, in the roof of the fourth ventricle, and under the pia mater of the upper segments of the cervical cord.
- ❖ Oedema and mild focal degeneration may be seen.
- ❖ Microscopic examination reveals no axonal damages in the first 12 hours; however, after 12 hours, they appear dilated and club shaped. Later, they appear ball-like, a condition known as **retraction of the balls**.



- Bleeding within the cranium is called Intracranial Haemorrhages.
- If the bleeding is small and thin layered, then it is called a haemorrhage.
- If it is large and space occupying, it is called a haematoma.



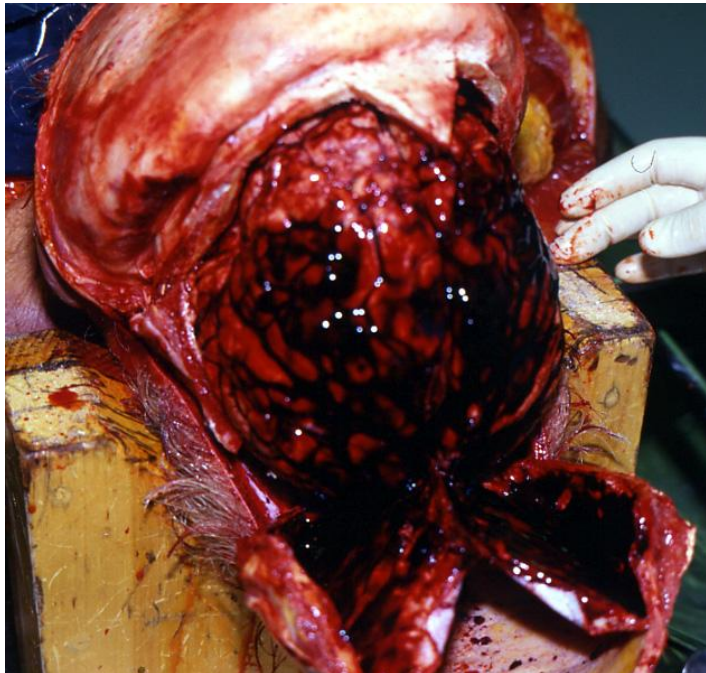
It is of 5 types.....



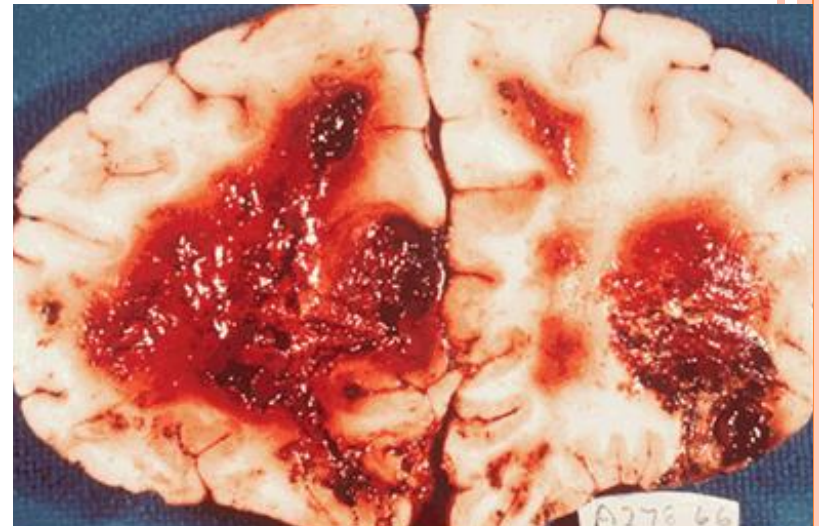
1. Epidural Haemorrhage



3. Subarachnoid Haemorrhage



2. Subdural Haemorrhage

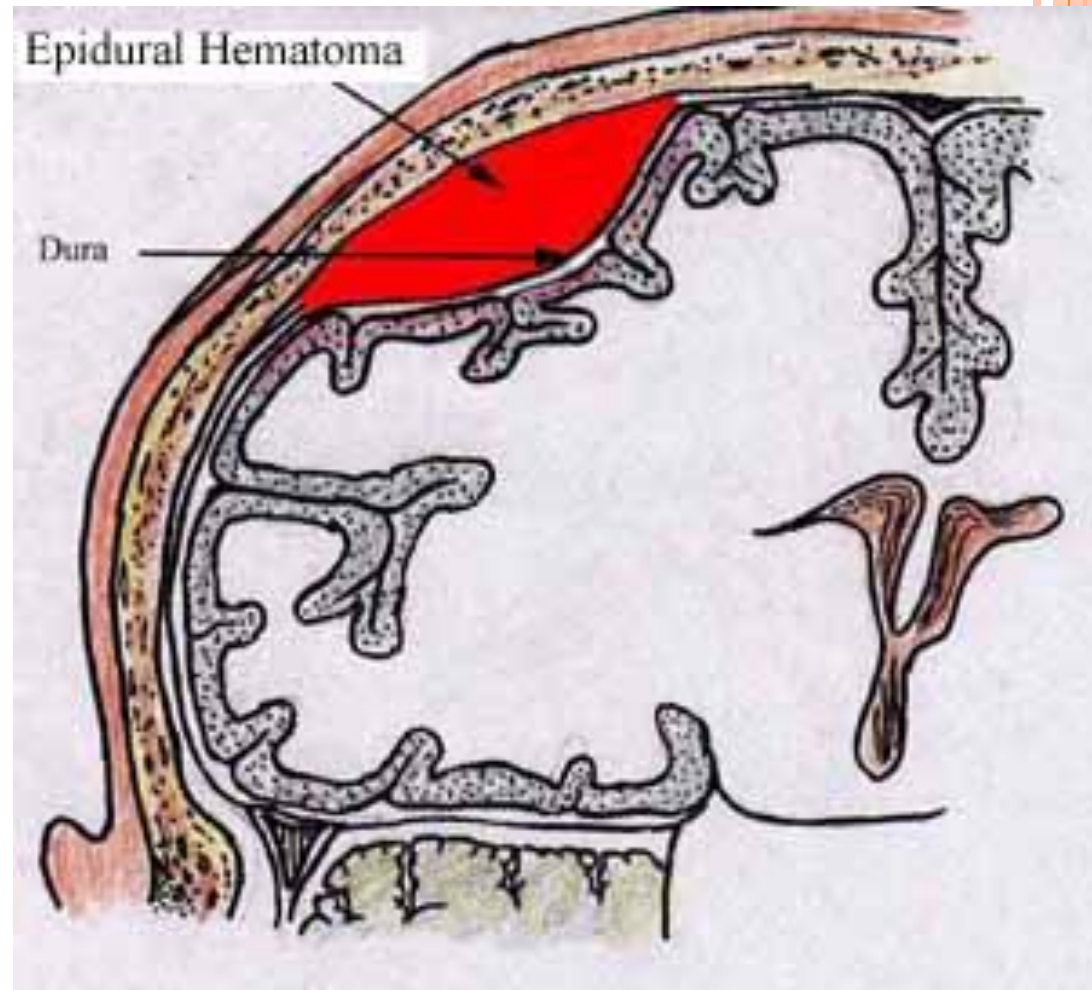


4. Intracerebral Haemorrhage

Epidural Haematoma

Definition:

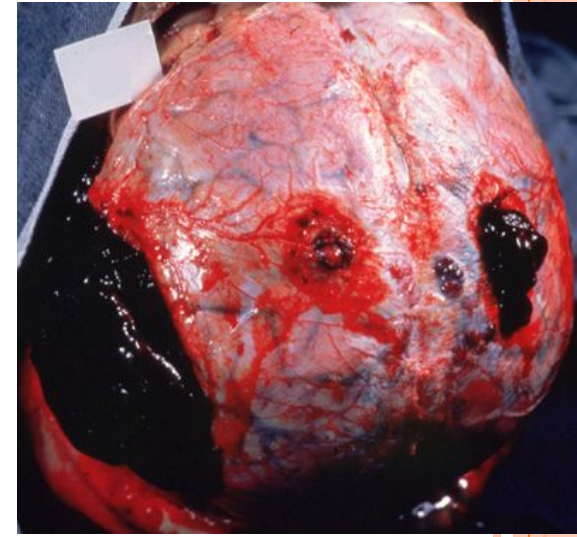
A Epidural / extradural Haematoma is a haemorrhage involving the collection of blood external to the dura mater, ie, between the dura and the inner surface of the cranium.



Epidural Haematoma

Features:

- Clinical features of epidural Haematomas usually follow a typical course; a brief transient period of unconsciousness, followed by a period of normal consciousness, called the “**lucid interval**”, and then, as a result of increasing pressure on the brain, a period of unconsciousness.
- During the lucid interval, there is weakness in the face and limbs on the side opposite to that of the haematoma. The pupil is fixed and dilated, and also, non-reactive to light on the same side as the haematoma.
- At the end of the lucid interval, the patient first becomes confused, and then appears drunk. This is followed by apparent sleep and then a comatose period.
- At this stage, there is bilateral pupillary dilatation and decerebrate rigidity.
- Ultimately, the person dies due to respiratory paralysis, resulting from damage to the vital centres in the brain stem.



EXTRADURAL/EPIDURAL HAEMORRHAG

Causes are—

- Rupture of diploic veins /venous sinuses /meningeal artery.
- The vessel most commonly involved is middle meningeal artery .

It is almost always traumatic in nature.

Lucid interval

The interval between two periods of unconsciousness.

It is seen in approx 27% cases.

Lucid interval usually seen in sub-acute variety.

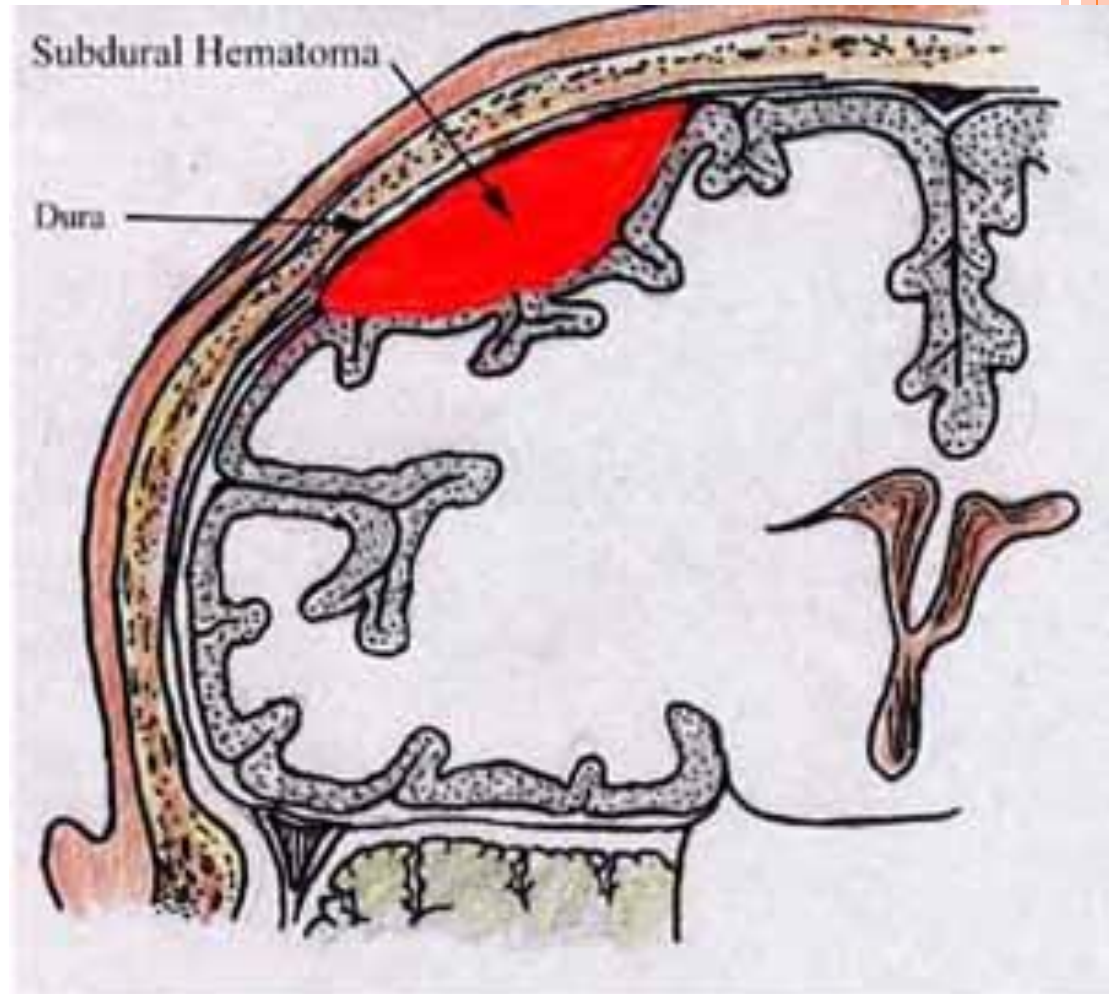
Medicolegal aspect

- If the patient discharged from the hospital during this period & died at home, then the doctor may be charged for negligence
- The condition resembles to drunken person, so the person may die in police custody.

Subdural Haematoma

Definition:

A Subdural haematoma is a haemorrhage which involves the extravasation of blood into the subdural space, ie, the space between the dura mater and the arachnoid mater.



SUBDURAL HAEMATOMA

- Seen between dura & arachnoid matter.
- It results due to rupture of dural venous sinuses/cortical veins.
- Death occurs if the volume of blood in the haemorrhage is between 100 to 150ml.
- It can be natural /traumatic.
- Natural:-hypertensive disorders due to atherosclerosis in elderly
 - bleeding disorders
 - leukemia
 - dural venous thrombosis
 - cerebral neoplasms

In natural cases, it is often bilateral while in traumatic variety, it is usually unilateral.

SUBDURAL HAEMATOMA

- It may be acute /subacute /chronic.
 1. Acute: signs evident within 24hrs.
 2. Sub-acute: signs evident after 24hrs-7days
 3. Chronic: signs evident after 7 days
- It may be primary /secondary.
- Primary: d/t injury to blood vessels
- Secondary: following injury to brain substance



Subarachnoid Haemorrhage

Definition:

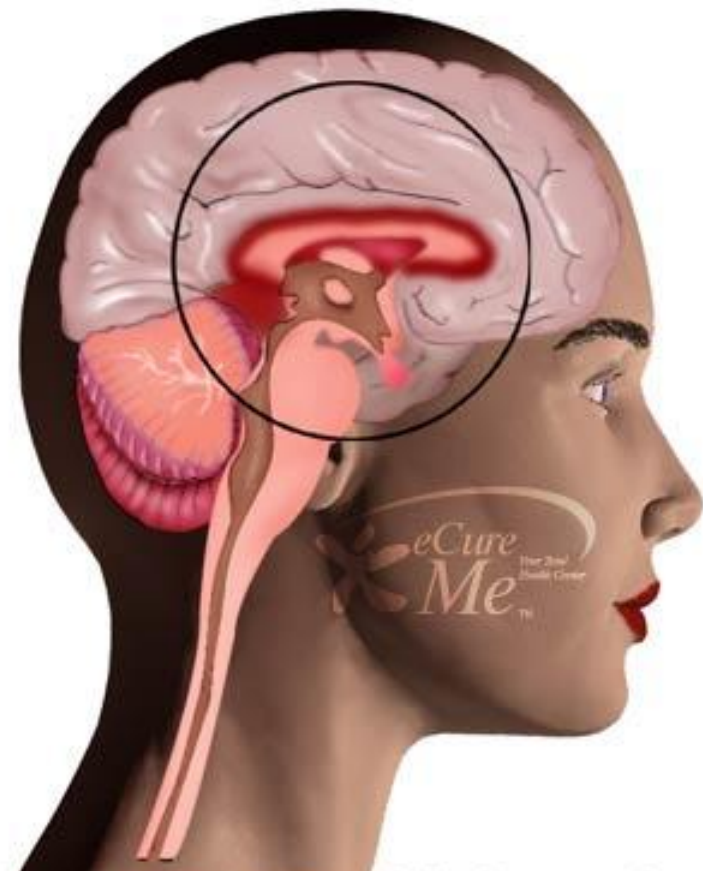
A Subarachnoid haemorrhage is collection of blood in the cerebrospinal fluid-filled subarachnoid space and cisterns of the brain.



Normal brain (front view)



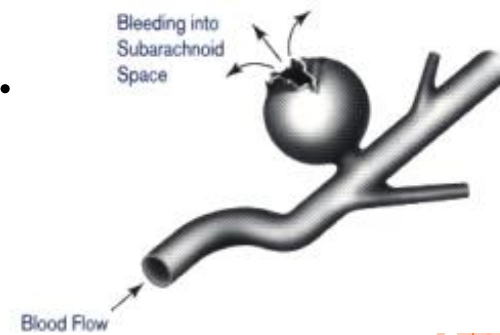
Subarachnoid hemorrhage



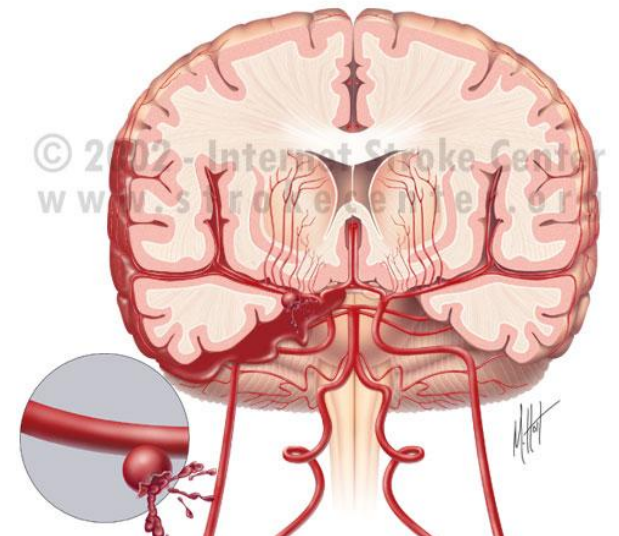
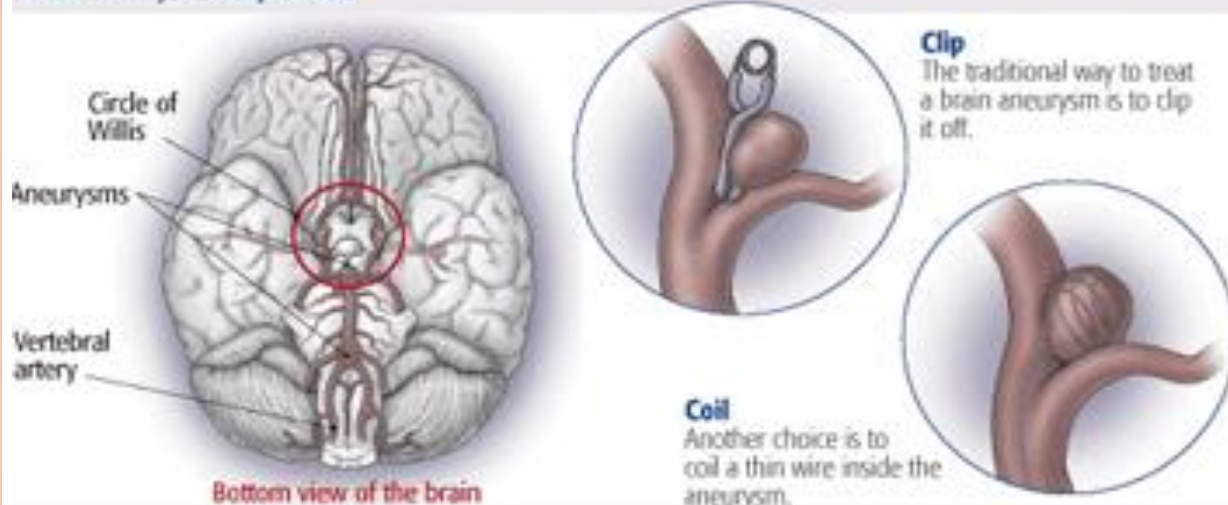


Causes: It may be natural /traumatic.

1. Rupture of the bridging veins near the sagittal sinus.
2. Lacerations and contusions of the brain and the pia-arachnoid.
3. Rupture of a saccular Berry aneurysm, usually located at one of the bifurcations of the vessels forming the Circle of Willis.



Brain aneurysms: Clip or coil



SUBARACHNOID HAEMORRHAGE

4. Angiomas and arteriovenous malformations cause spontaneous bleeding.
5. Asphyxia
6. Blood dyscrasias and leukaemias, in which mild trauma can precipitate bleeding.
7. Tears of ventricular ependyma
8. Rupture of an old intracerebral haemorrhage, due to a stroke, for example.
9. Sickle cell disease

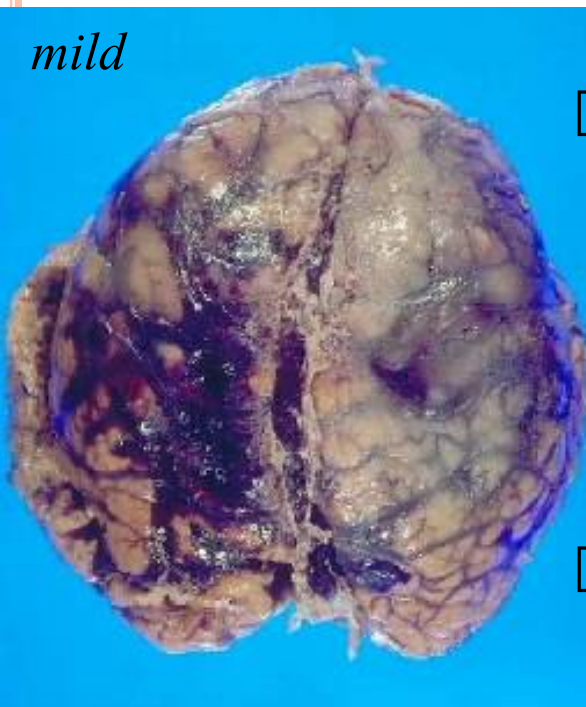


Features:



mild

□ In the mild form, it does not cause any significant brain damage, and appears as splashes of haemorrhage of contused areas of the brain.

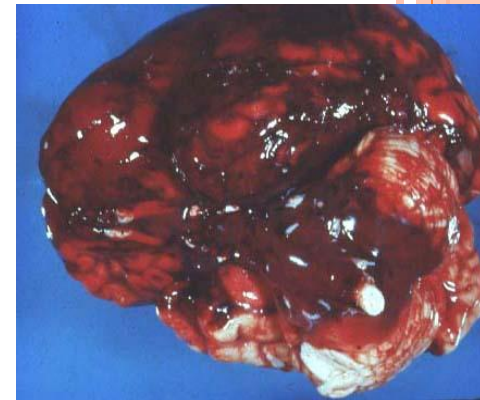


mild

□ In severe haematomas, it is present over most of the hemispheres, and is accompanied by subdural bleeding

□ It is mostly venous.

severe



severe

Intracerebral Haemorrhage

Definition:

An Intracerebral Haemorrhage is the extravasation of blood on to the surface of the brain, into the substance of the brain, or into the ventricles of the brain.



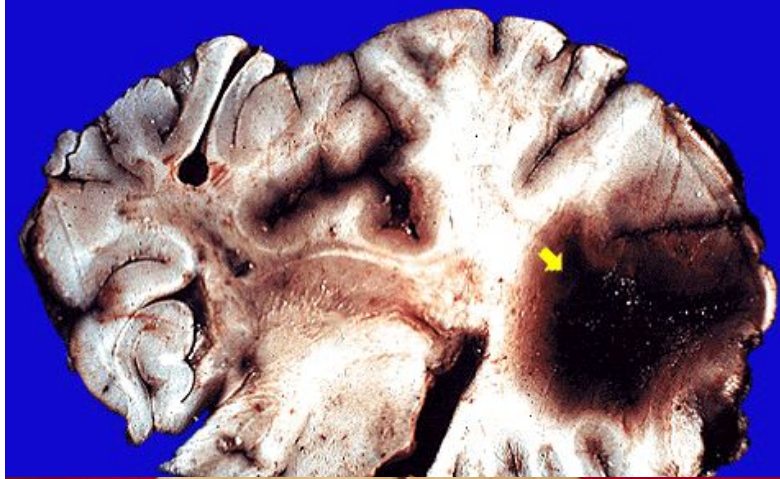
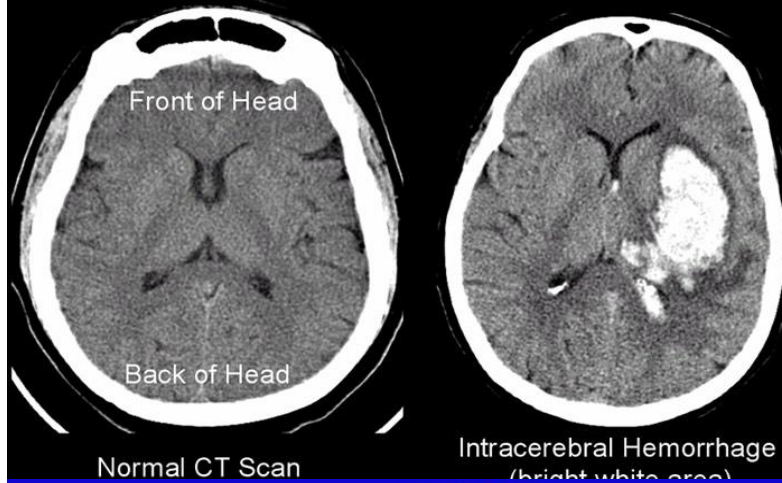
Intracerebral Haemorrhage



INTRACEREBRAL BLEEDING

- It may be either parenchymatous or intraventricular.
- It may natural / traumatic
- Natural:-Hypertensive disorders due to atherosclerosis in elderly
 - bleeding disorders
 - leukemia
 - cerebral neoplasms
 - septicemia
 - fat embolism





Features:

- Most often, bleeding occurs at the time of accident. But, sometimes, in the case of venous or capillary damage, slow oozing of blood occurs. In rare cases, no bleeding occurs at first, but with weakening of the vessels, marked bleeding occurs.
- Further bleeding occurs due to damage of smaller vessels by the expanding haematoma.



COMPLICATIONS OF INTRACRANIAL INJURIES

1. Infection- meningitis, brain abscess
2. Dissecting aneurysm due to injury to blood vessel.
3. A-V communication
4. Cerebral softening
5. Post traumatic amnesia / neurosis
6. Post traumatic epilepsy
7. Post traumatic encephalopathy
8. Post traumatic tumors like meningioma, malignant Glioma, acoustic neurofibroma
9. Disability: Physical- paralysis, sensory disturbances, visual defects, ataxia etc.
10. Psychic- lack of physical confidence



TRANSPORTATION INJURIES

1. Vehicular injuries
2. Railway injuries
3. Aircraft injuries



INJURIES TO PEDESTRIAN

1. Primary impact injuries
2. Secondary impact injuries
3. Secondary injuries or tertiary injuries

Injuries to traveller

Primary collision

Secondary collision



SPINAL INJURIES

- Whiplash injuries





The End