

Head Injury

Introduction

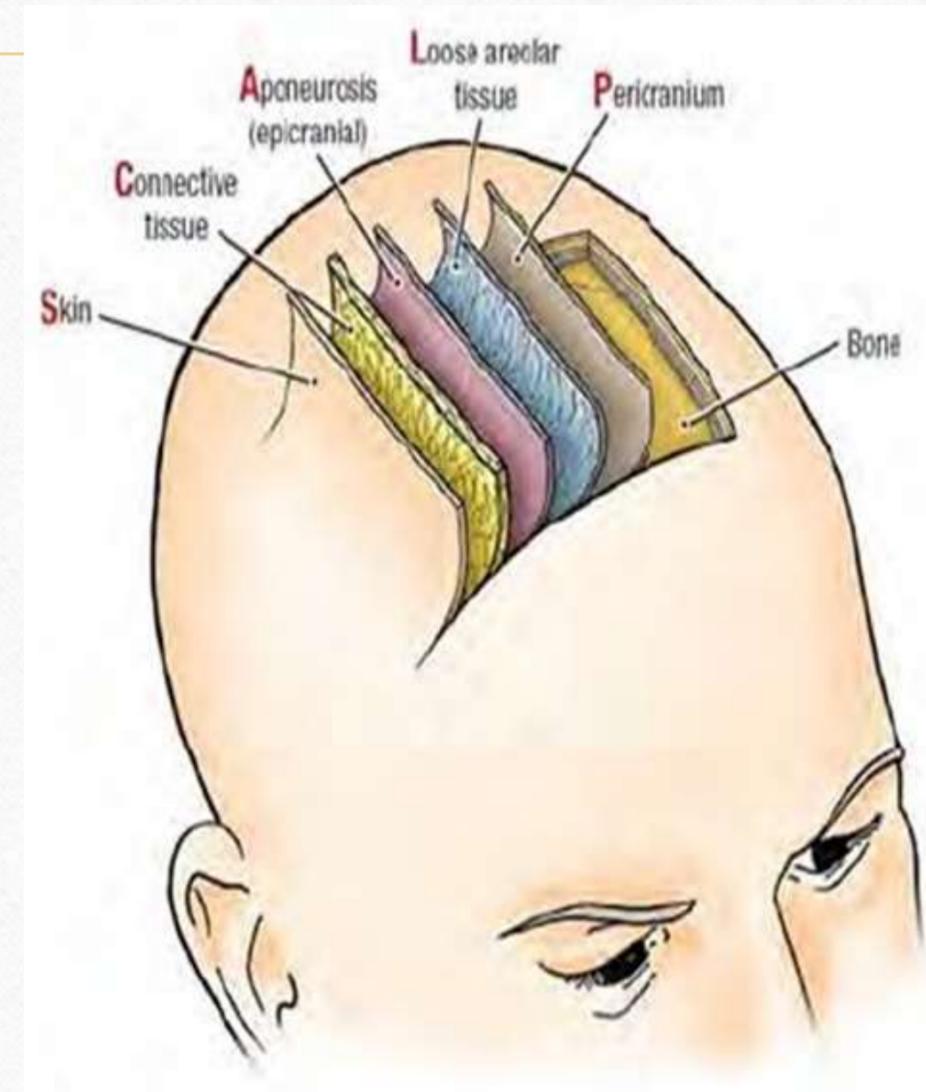
- **Head injury** is any trauma that leads to injury of the scalp, skull, or brain which is produced by mechanical forces
- These injuries most often occur in individuals who are **15-24 years** old and are twice as common in men
- **Vehicular accidents** being most common in those under 25 years
- **Falls** in those over 75 years

Classification

- Head injuries can be classified broadly into:
- Scalp injury.
- Skull injury.
- Brain injury.

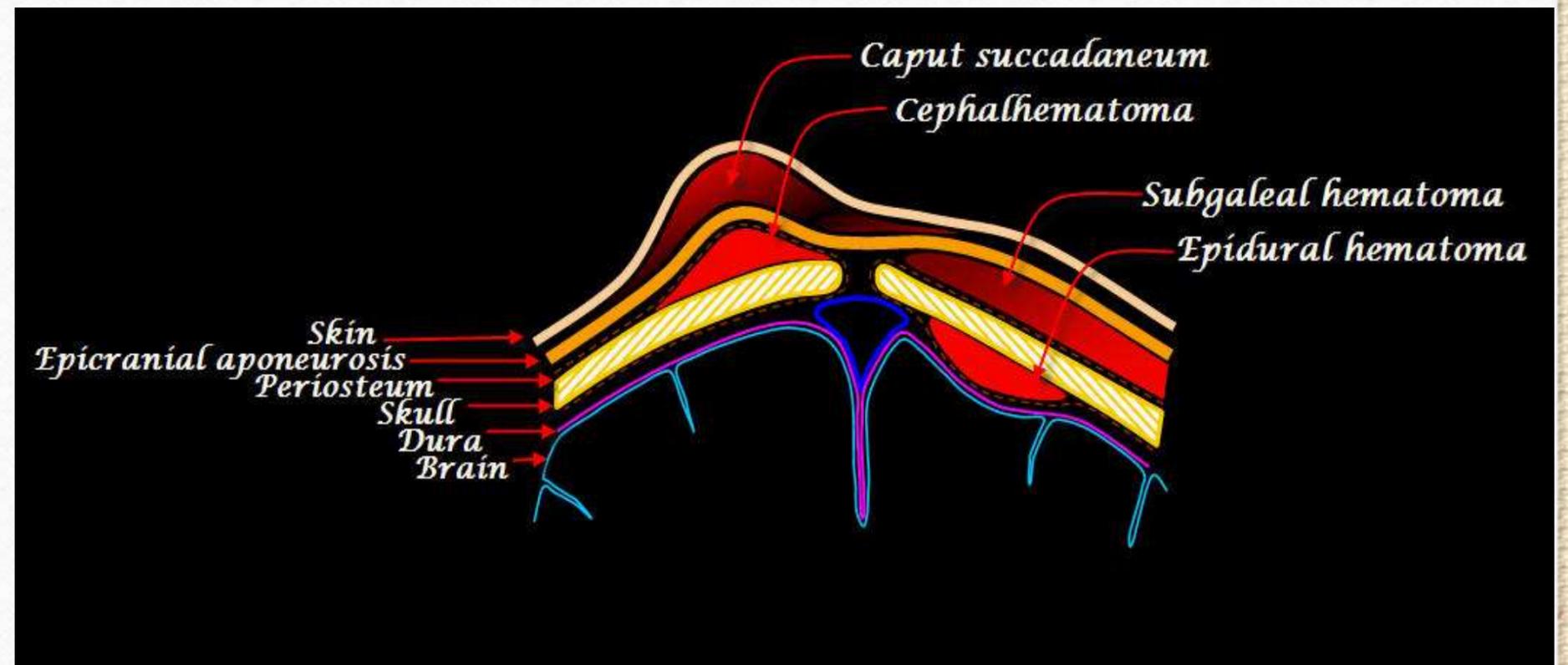
Scalp anatomy

- Skin
- Connective tissue
- Aponeurosis
- Loose connective tissue
- Periosteum



Scalp injury

- It can manifest as:
 1. Abrasion.
 2. Bruising.
 3. Laceration.
 4. Neonatal scalp hematomas



Neonatal scalp hematomas



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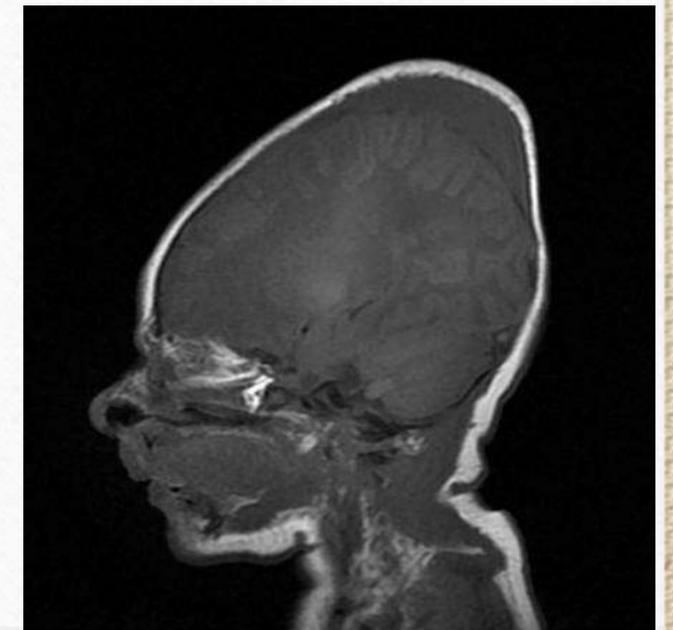


Neonatal scalp hematomas

- Neonatal scalp hematoma is a swelling that occurs to a baby's scalp shortly after delivery. During childbirth, especially during head-first deliveries, pressure exerted on a baby's head can damage the scalp, leading to scalp hematomas.
- three types:
 - Caput succedaneum.
 - Subgaleal hematoma
 - Subperiosteal cephalhematoma.
- Subdivided by location, BUT
 - Ultrasound cannot identify the layers of the scalp, so we must generally rely on other features to distinguish one type of hematoma from another

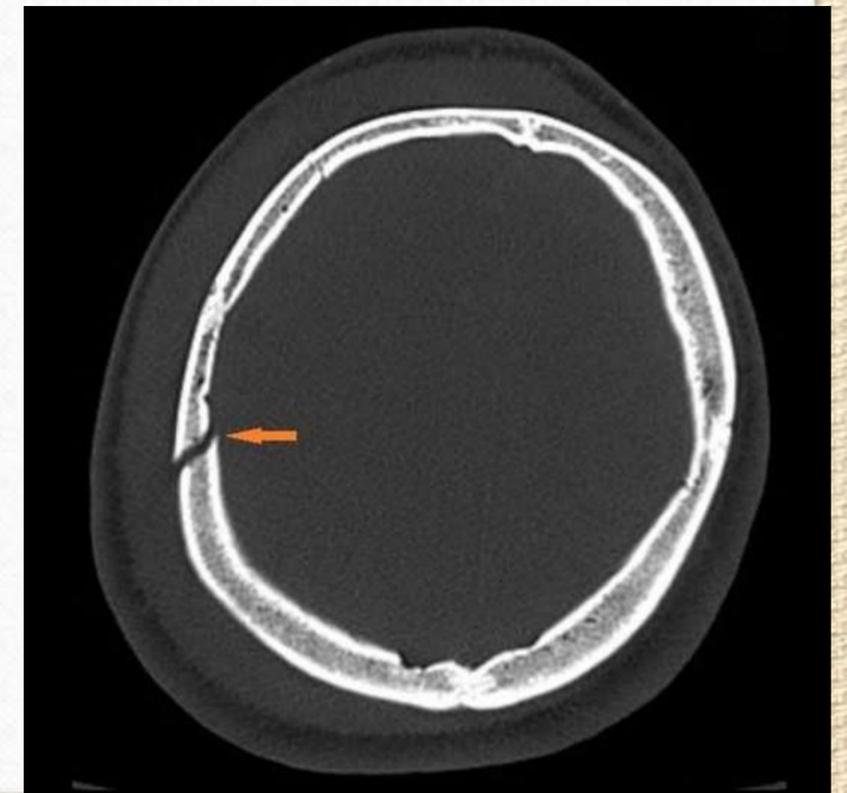
1) Caput succedaneum

- caput Succedaneum: poorly defined; localized soft tissue **edema**
 - ✓ Maximal size at birth & gradual resolves over hours or days
 - ✓ Caused by pressure of skull against dilating cervix or vacuum assisted delivery
 - ✓ Located at the presenting portion of the skull or vacuum placement site



2) Subgaleal hematoma

- Caused by vacuum/forceps assisted delivery or head trauma such as intracranial hemorrhage or skull fracture.
- Results from bleeding from the emissary veins into the loose connective tissue layer
- Wide-spread
Sub-galeal space covers the entire cranium
- So
Not limited by sutures / No barriers to limit bleeding
Blood will shift



2) Subgaleal hematoma

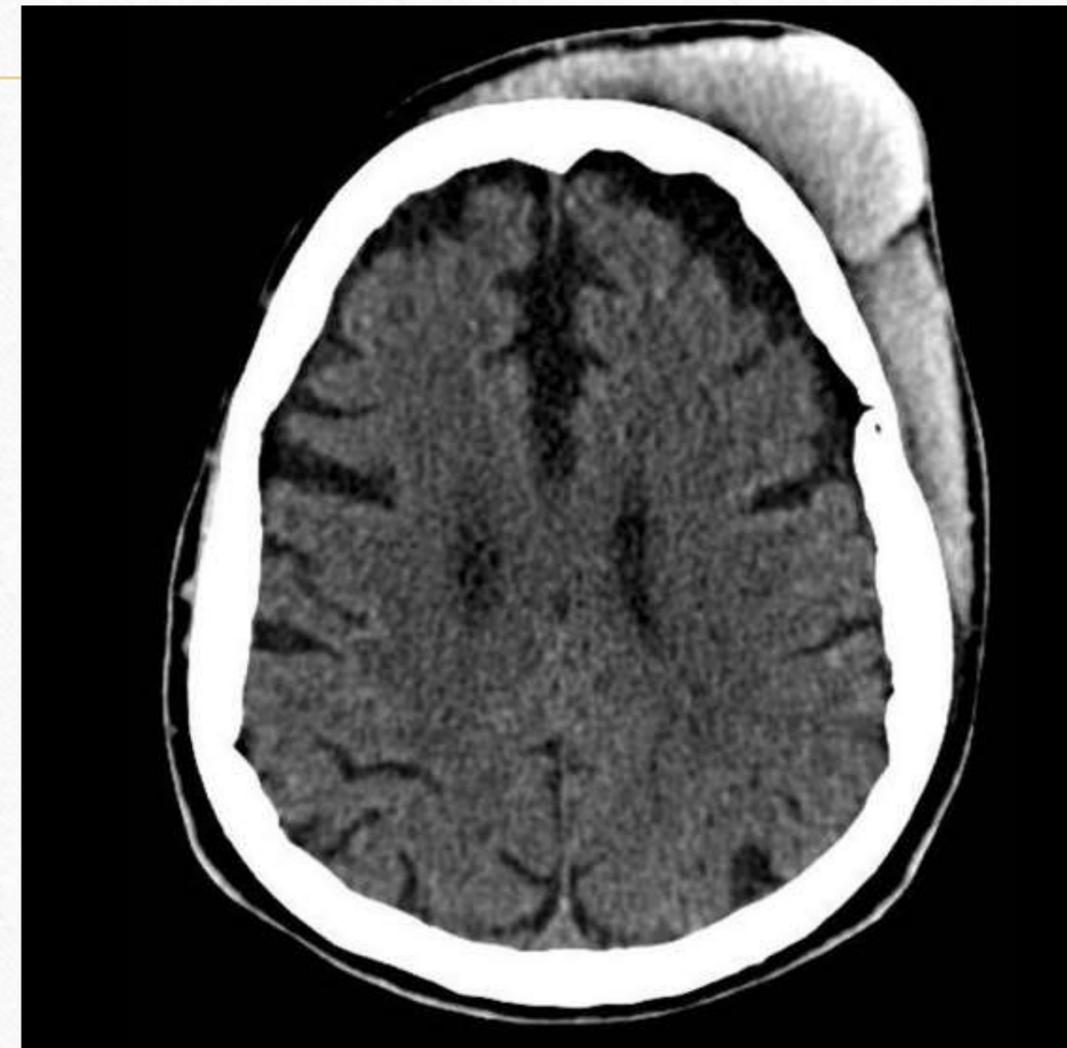
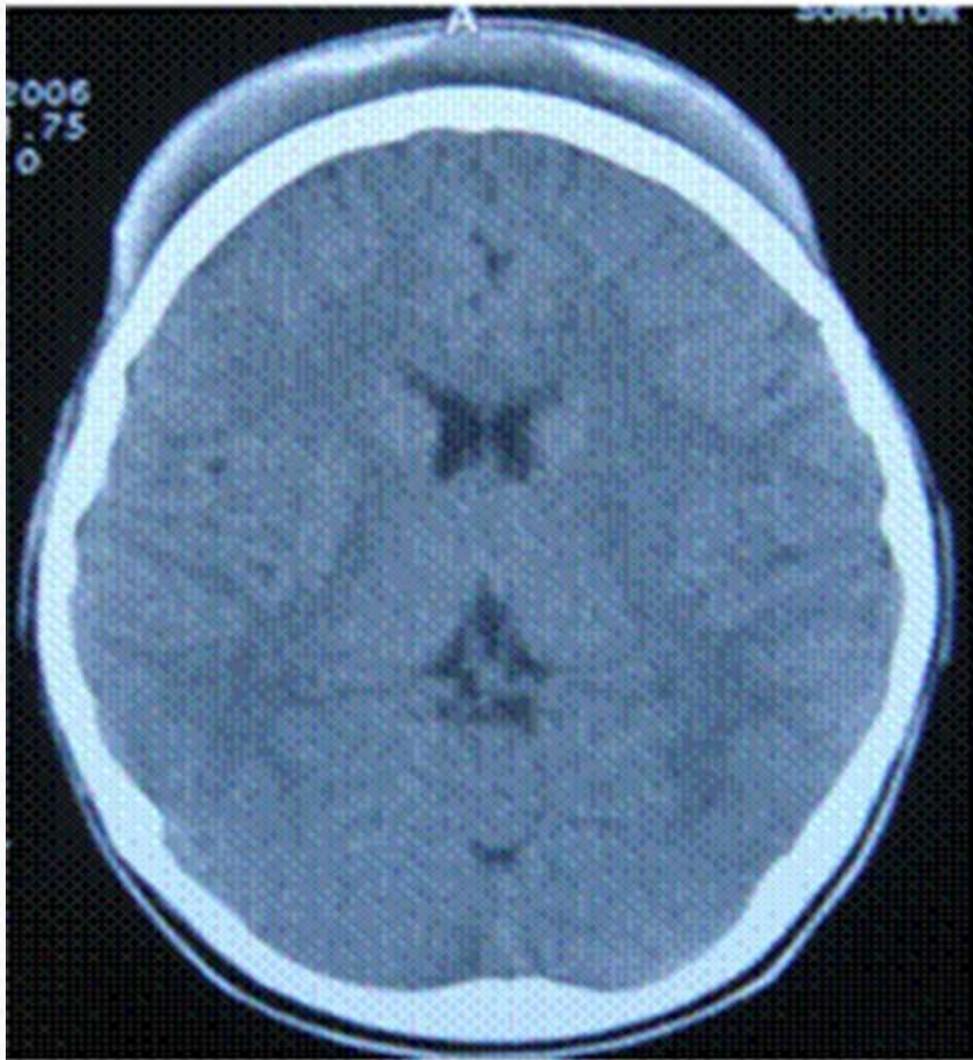
- Blood loss may be massive and Patients may present with **hemorrhagic shock**

Usually develop slowly 12–72 hours after delivery

may be noted immediately after delivery in severe cases

- Symptoms signify extensive blood loss
 - Increased circumference
 - Decreased hematocrit; increased bilirubin
 - Neurological disturbances (seizures, etc.)

2) Subgaleal hematoma

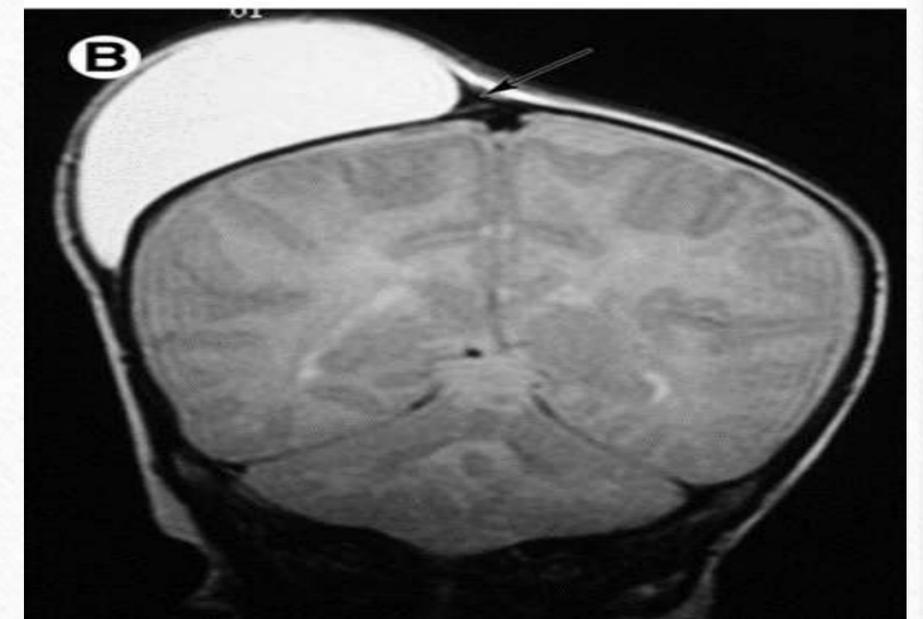
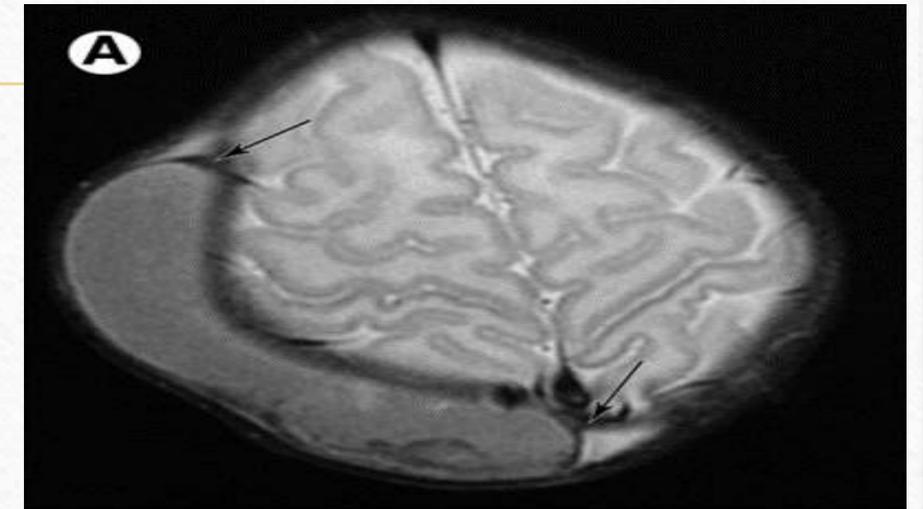


2) Subperiosteal cephalhematoma

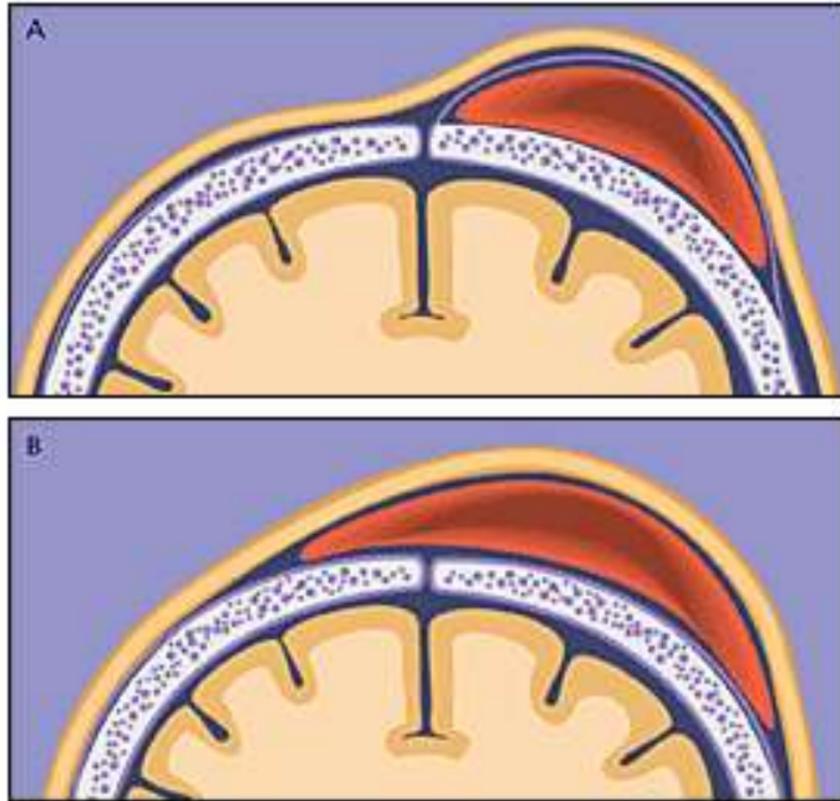
- blood between the skull and the periosteum secondary to rupture of a blood vessel crossing the periosteum.
 - firm
 - Scalp moves freely over the mass.
 - Usually over the parietal bone
 - Mostly doesn't cross the midline. / Bound by sutures
 - Well defined margins

2) Subperiosteal cephalhematoma

- Caused by vacuum/forceps assisted delivery
- In 80% of cases treatment is conservative.
- Observe, give good **analgesia** and avoid aspiration in newborns (risk of infection and abscess).



Subgaleal hematoma V/S Subperiosteal hematoma



	Subgaleal	Subperiosteal
Site	Between aponeurosis of the scalp muscle and periosteum	under the periosteum
Cross suture	Cross sutures	Doesn't cross
Treatment	Observation	analgesia + observation

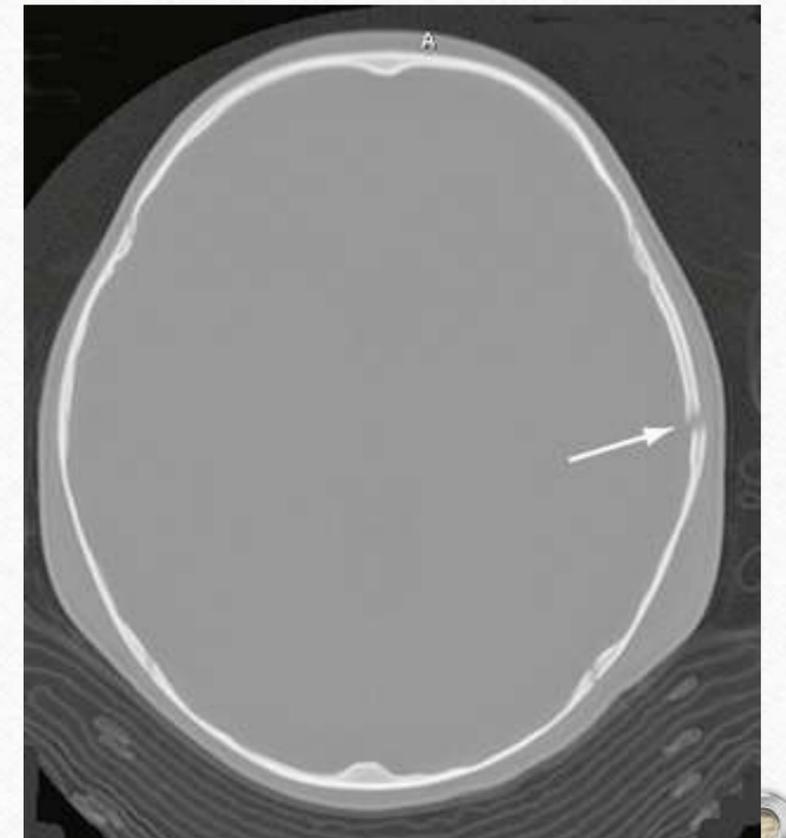
Cephalohematoma versus subgaleal hematoma. (A) Cephalohematomas are limited to suture lines. (B) In subgaleal hematomas, the bleeding crosses suture lines, causing diffuse swelling that can indent on palpation.

Skull fractures

- **Linear fractures** which are the most common.
- **Depressed fractures.**
- **Skull base fracture.**

Linear skull fractures

- A break in the bone that transverses the full thickness of the skull from the outer to inner table, most commonly caused **a blunt trauma**.
- usually of little clinical significance

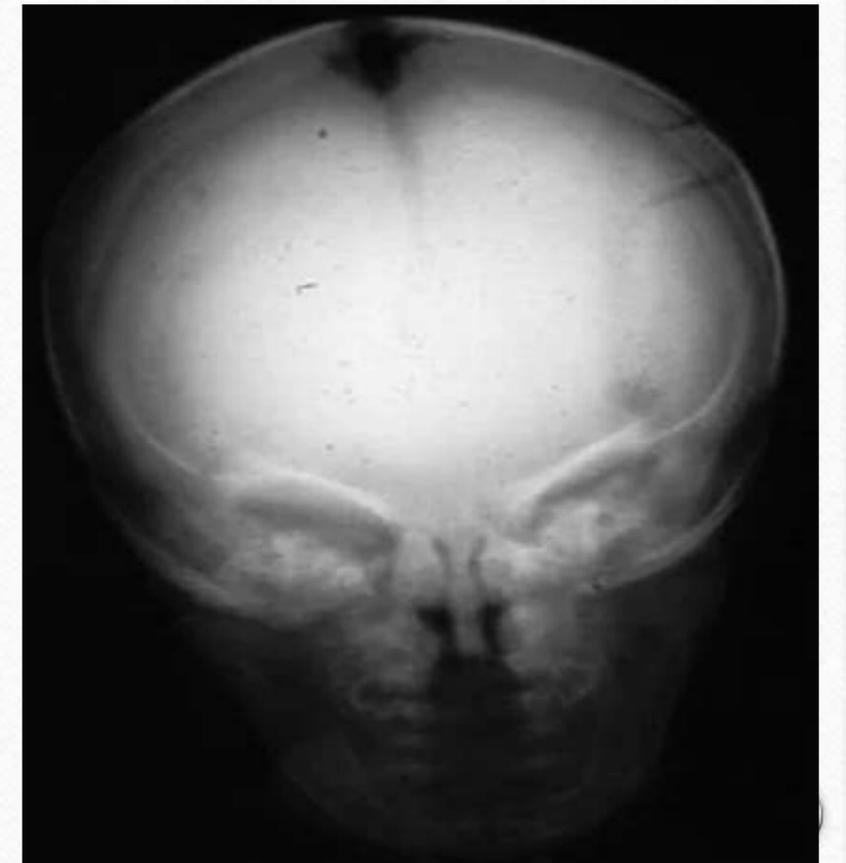


Conditions that might complicate a linear skull fracture

- **Bleeding** from a fractured bone might leak into the epidural space and cause epidural hematoma.
- Venous sinus injury if the fracture is **near to a venous sinus**.
- **Diastatic fracture:** occur when the fracture line transverses one or more sutures of the skull causing a widening of the suture.

Diastatic fracture

- While this type of fracture is usually seen in infants and young children as the sutures are not yet fused it can also occur in adults.
- in adults it usually affects the lambdoidal suture as this suture does not fully fuse in adults until about the age of 60 years.



Skull base fracture

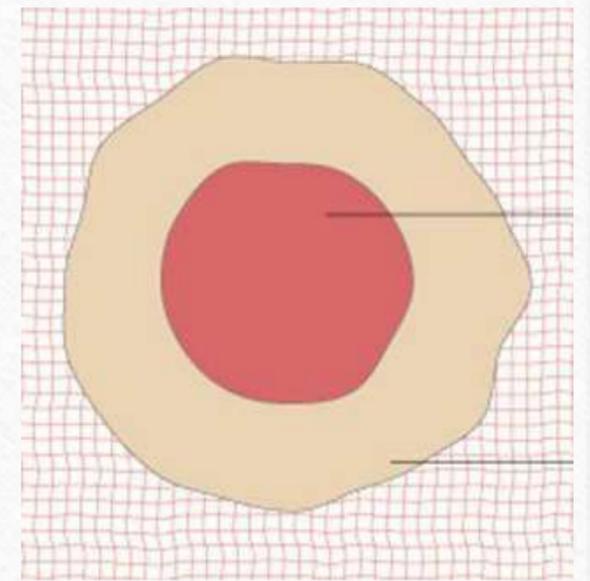
- Refers to any fracture found at the base of the skull.
- The temporal bone is involved in 75% of cases, but the occipital, sphenoid, and ethmoid bones may also be involved.
- **Traumatic cerebrospinal fluid (CSF) leaks** occur in 10-30% of basilar skull fractures(either through the nose (**rhinorrhea**) or through the external auditory meatus (**otorrhea**)
- They require more force to cause than other areas of the neurocranium; thus they are rare (4%).

Symptoms and signs of basilar skull fracture

-
- **Rhinorrhea:** CSF leak through the nose. ask the patient if any watery colorless fluid is coming out of his nose.
 - **Otorrhea:** CSF leak through the ear, accompanied with tympanic membrane tear.
 - **Hemotympanum:** accumulation of CSF and blood behind the tympanic membrane.
 - **Battle's sign:** Ecchymosis over the mastoid process, indicates a fracture of the posterior cranial fossa.
 - **Raccoon eyes:** Periorbital ecchymosis, indicates fracture to the frontal portion of the skull base.

Symptoms and signs of basilar skull fracture

- Conductive hearing loss.
- Anosmia.
- Nystagmus.
- CSF mixed with blood forms the halo sign when allowed to drip onto filter paper. Contrary to traditional teaching, this sign is not specific to CSF, and may result in false-positives.

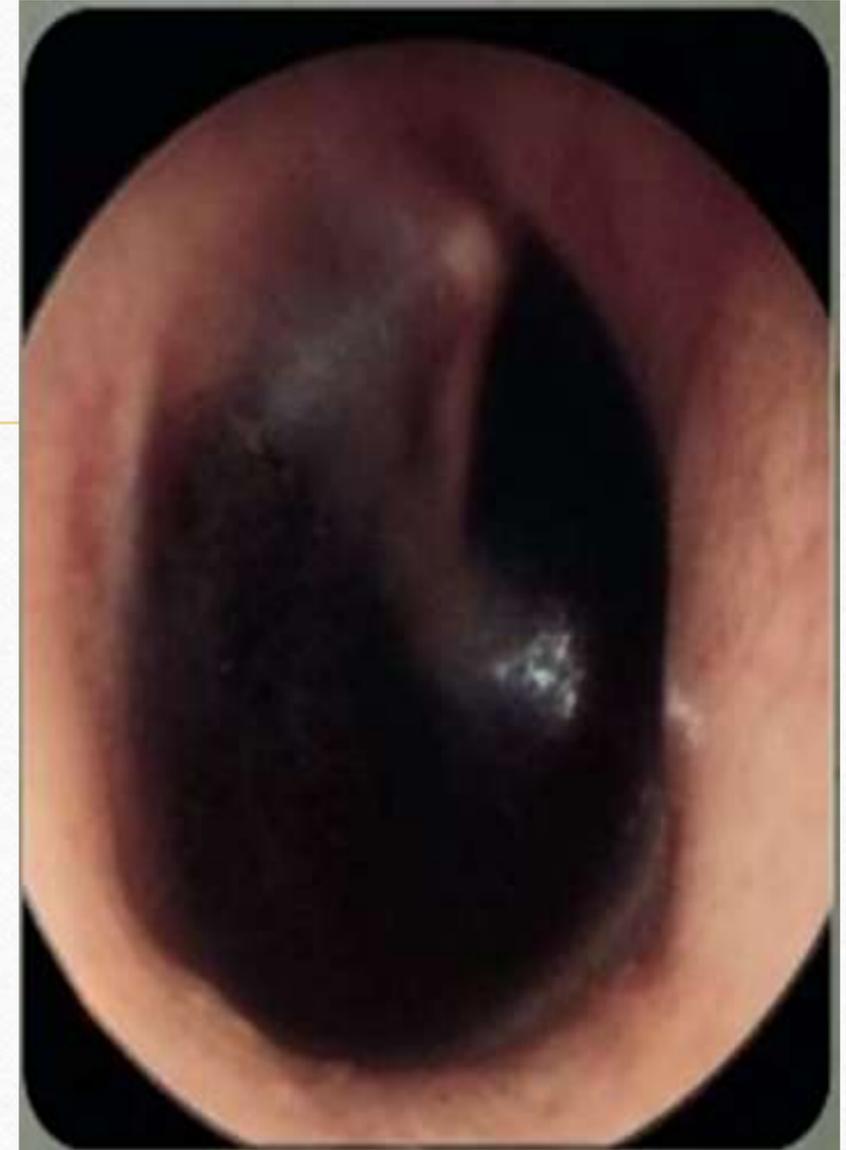




Battle's Sign
(retroauricular
ecchymosis)



Raccoon's Sign
(periorbital ecchymoses)



Hemotympanum

Management

- All patients with basilar skull fractures should be admitted for observation.
- stabilize airway, ventilation, and circulatory issues is the priority.
- cervical spine immobilization
- Neurological assessment every 2hrs.
- Antibiotics.
- Most post-traumatic CSF leaks heal with a conservative management of bed rest and head elevation.

■ **Surgery: if there's**

- Traumatic aneurysms.
- Posttraumatic carotid cavernous fistula.
- Meningitis or cerebral abscess.
- Facial palsy.
- Cosmetic deformities.

Depressed skull fracture

- A fracture of where part of the fractured bone is folded (depressed) inward into the cerebral parenchyma.
- 75-90 % are compound.
- 10-15% are associated with sinus injury.
- 2 types:
 - One piece fracture.
 - Comminuted fracture (multiple pieces).



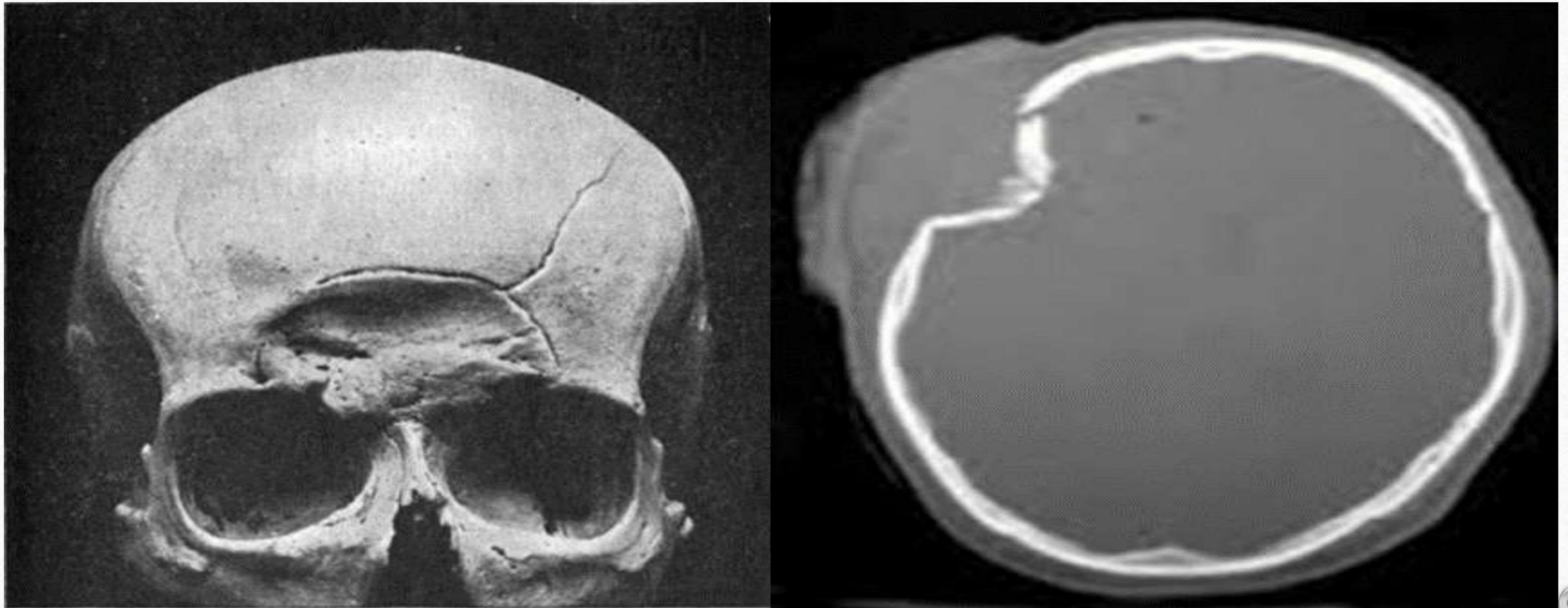
Depressed fractures

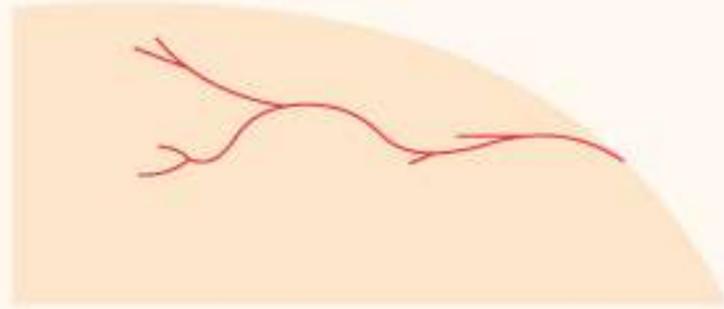
- Treatment could be:
 1. Conservative.
 2. Elevation.
 3. Craniectomy with immediate/delayed cranioplasty.

Depressed fractures

- Criteria to elevate a depressed skull (surgical management):
 - Full thickness or more than 1 cm bone depression.
 - CSF leak.
 - Seizures.
 - Compound fracture.
 - Neurological signs.
 - Cosmetic.
 - Overlying an eloquent area of the brain.
 - associated intracranial hematoma with mass effect that requires evacuation.

Depressed fractures

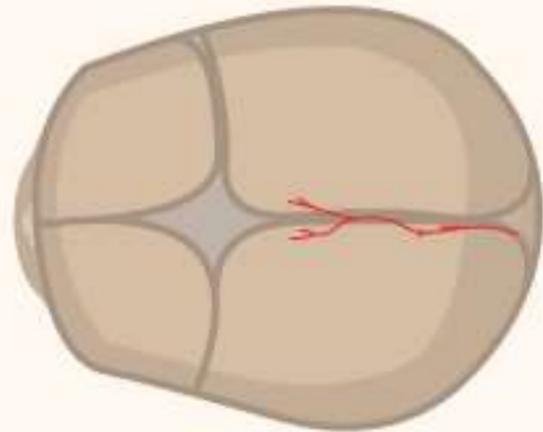




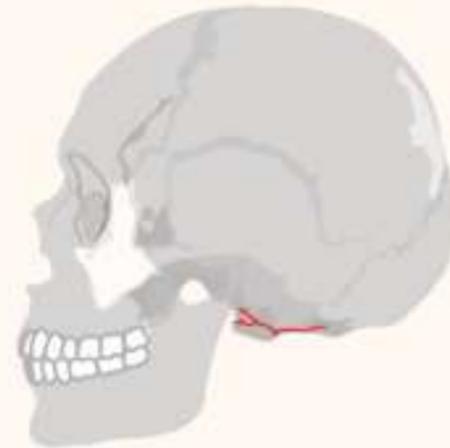
LINEAR FRACTURE



DEPRESSED FRACTURE



DIASTATIC FRACTURE

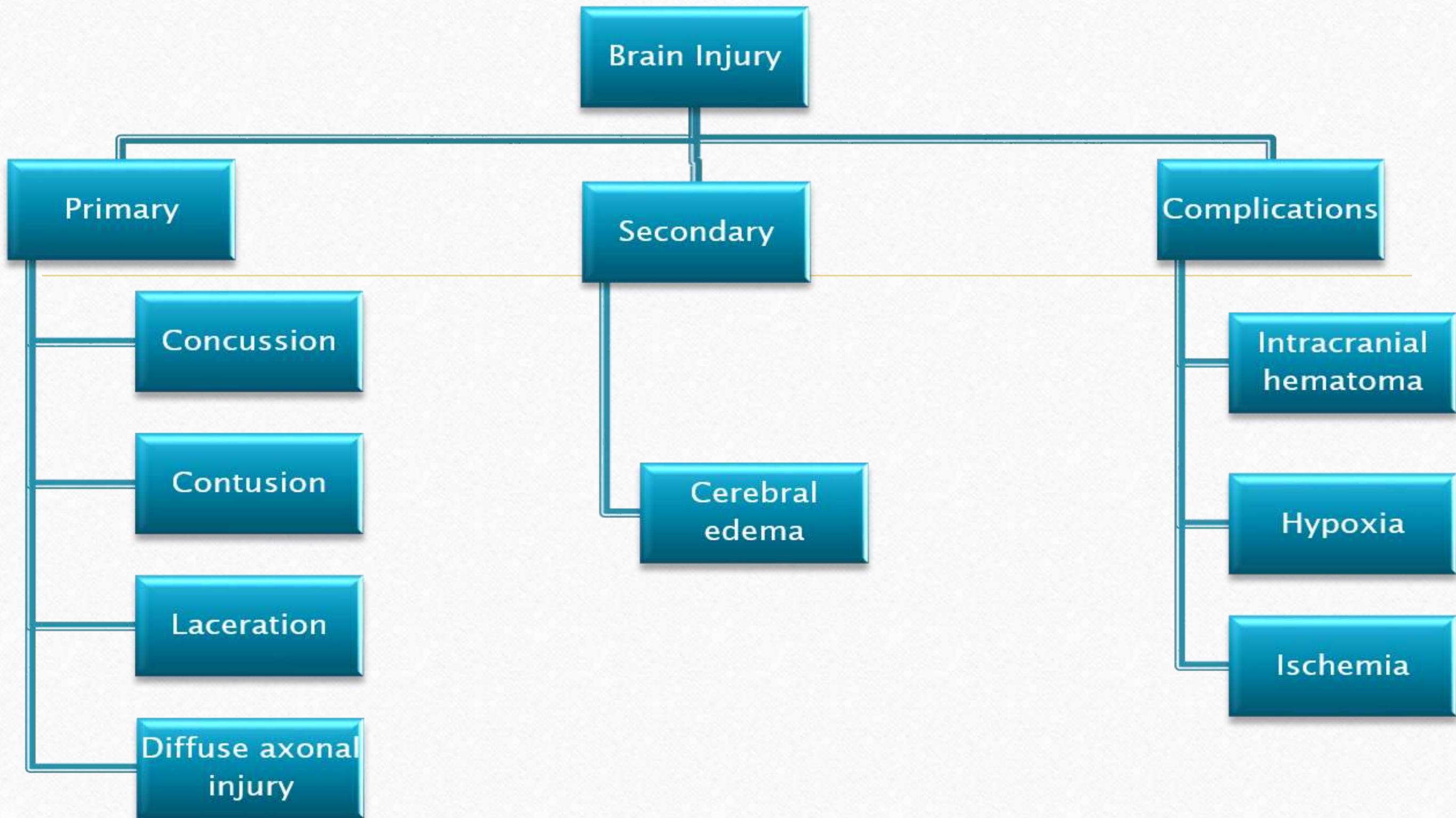


BASILAR FRACTURE

In adult and Children

The parietal bone is most frequently fractured, followed by the temporal, occipital, and frontal bones . Linear fractures are the most common, followed by and basilar skull fractures depressed

Brain injury



Primary brain injury

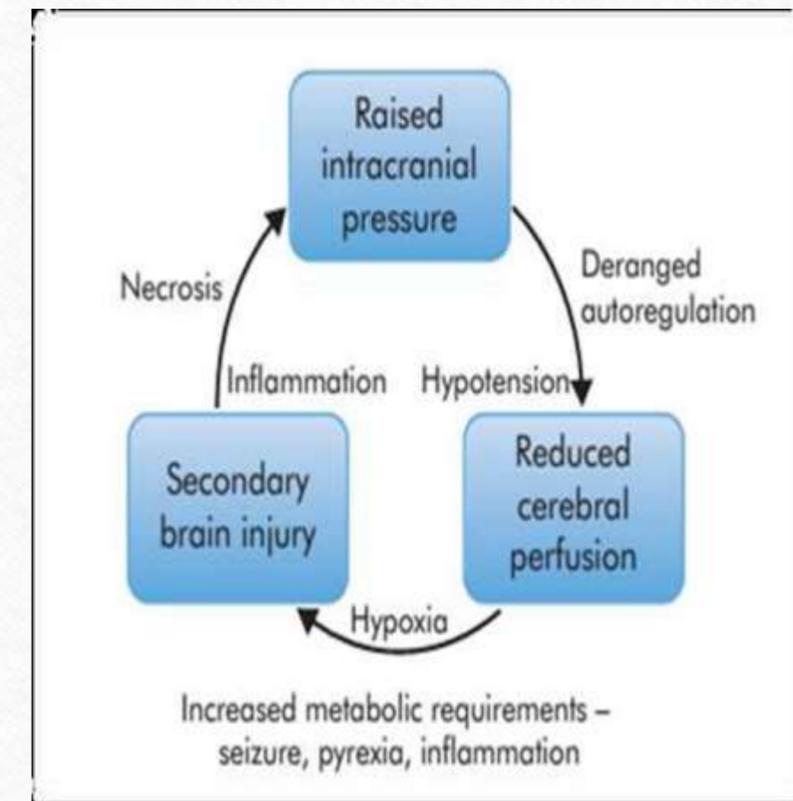
- Primary brain injury occurs at the time of trauma.
- It results from external mechanical forces transferred to intracranial contents.
- The damage that results includes a combination of focal contusions and hematomas, as well as shearing of white matter tracts (diffuse axonal injury) along with cerebral edema and swelling.

Primary brain injury

- Common mechanisms include:
 1. Direct trauma.
 2. Acceleration/ deceleration injuries.
 3. Shearing forces.

Secondary brain injury

- Secondary brain injury occur after hours to days after trauma → impairment in CBF → edema → increase ICB .



Cerebral contusions

- Contusions simply are bruising of brain parenchyma.
- refers to a focal region of necrosis and hemorrhage usually involving the cerebral cortex and subcortical white matter.

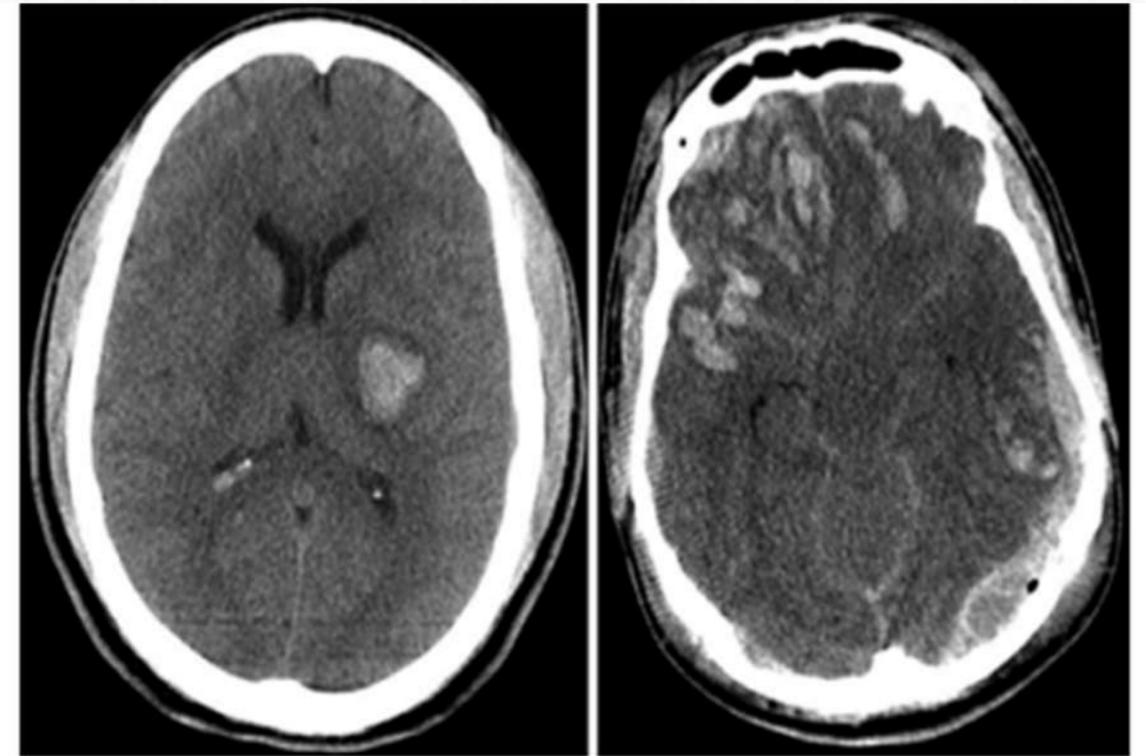


FIG. 1. Computed tomography images showing different patterns of contusions.

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- Contusions may be present in any part of the brain but are most common in **the frontal** and **temporal lobes**. particularly in places where the brain comes into contact with the irregular contours of the skull base
 - Contusions can range in appearance from the more solid hematoma to a classic salt-and-pepper appearance.

-
- About half of contusions managed conservatively would progress radiologically over time in hospital.
 - Patients with a poor initial GCS score and large contusions are at an increased risk of requiring delayed surgical intervention.
 - Routine serial imaging for patients with small contusions and normal GCS score is less likely to alter their management, especially beyond 48 hours.

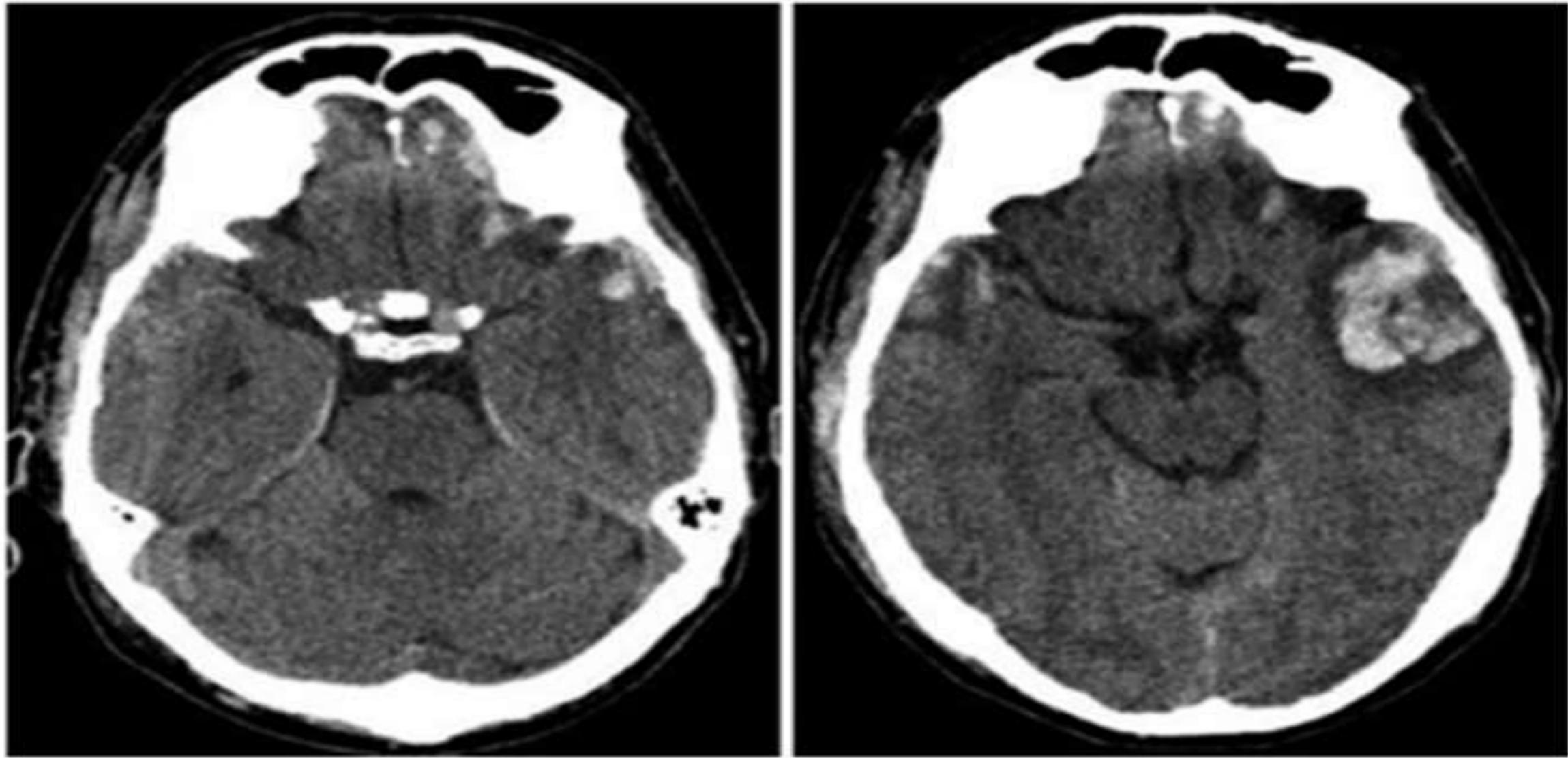
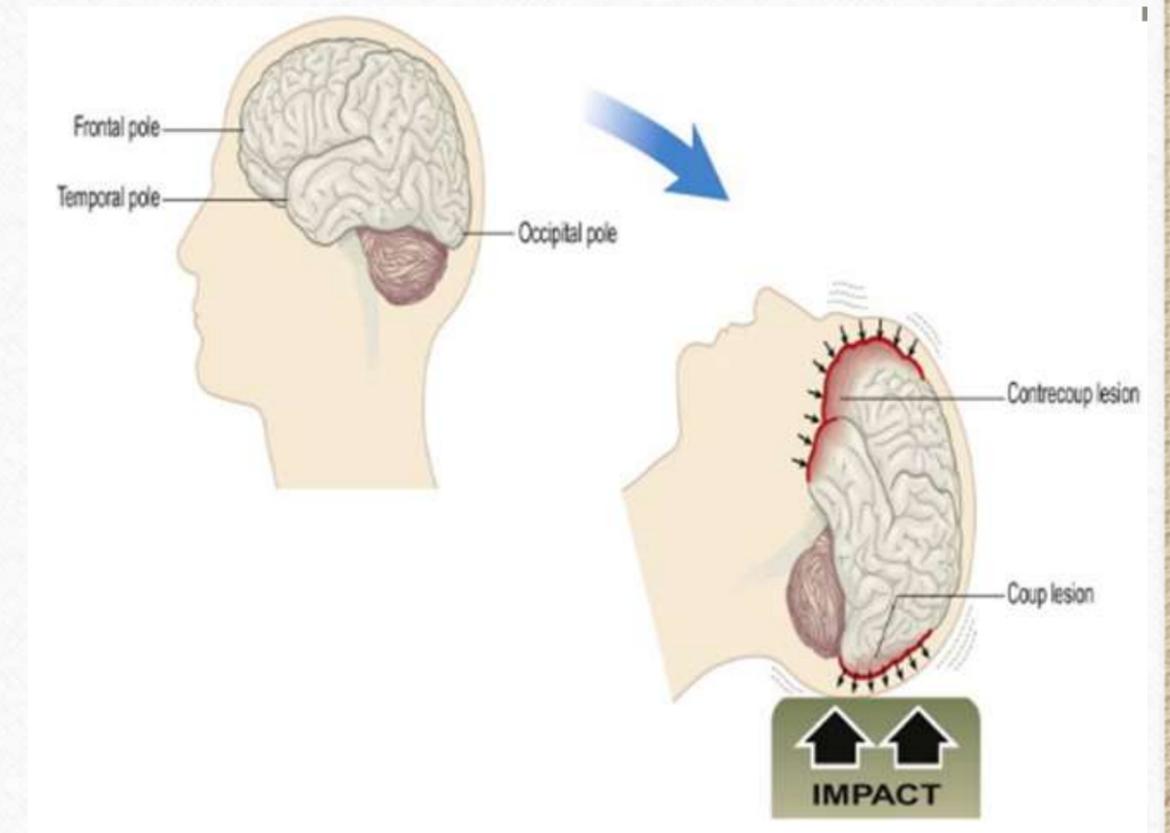


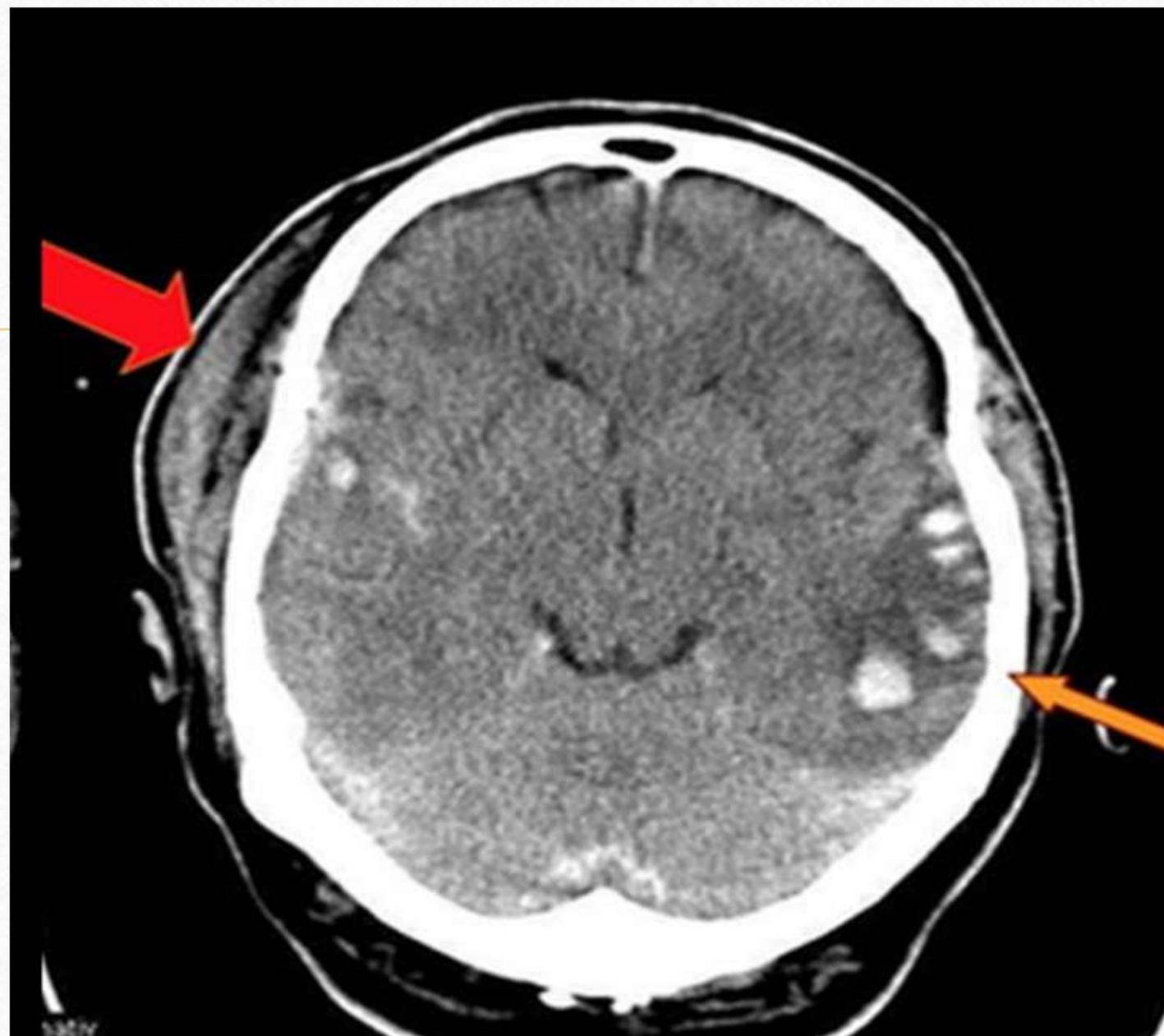
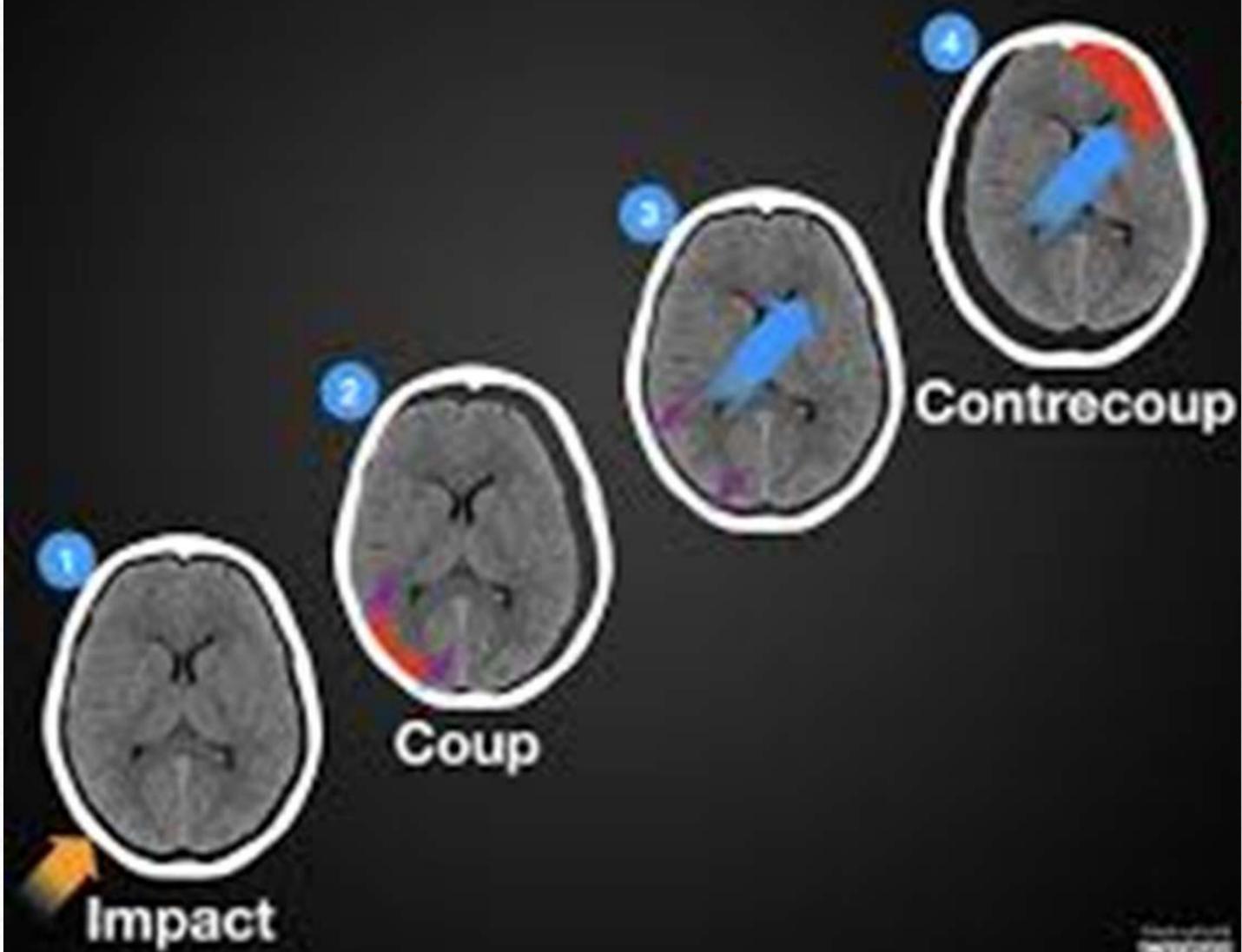
FIG. 2. Computed tomography images showing contusion progression between the initial (*left*) and the follow-up scan (*right*).

Coup or Contrecoup contusions

- Coup contusions occur at the location of impact.
- Contrecoup contusions occur on the opposite side or at a point distant from the impact.



Coup-contrecoup injury



Coup (Red)
Contrecoup Contusion (Orange) (at 180 degrees)

Concussion

- 1- No structural deformity to the brain •
- 2- unconscious then return consciousness •
- 3- Retrograde amnesia •

Diffuse axonal injuries

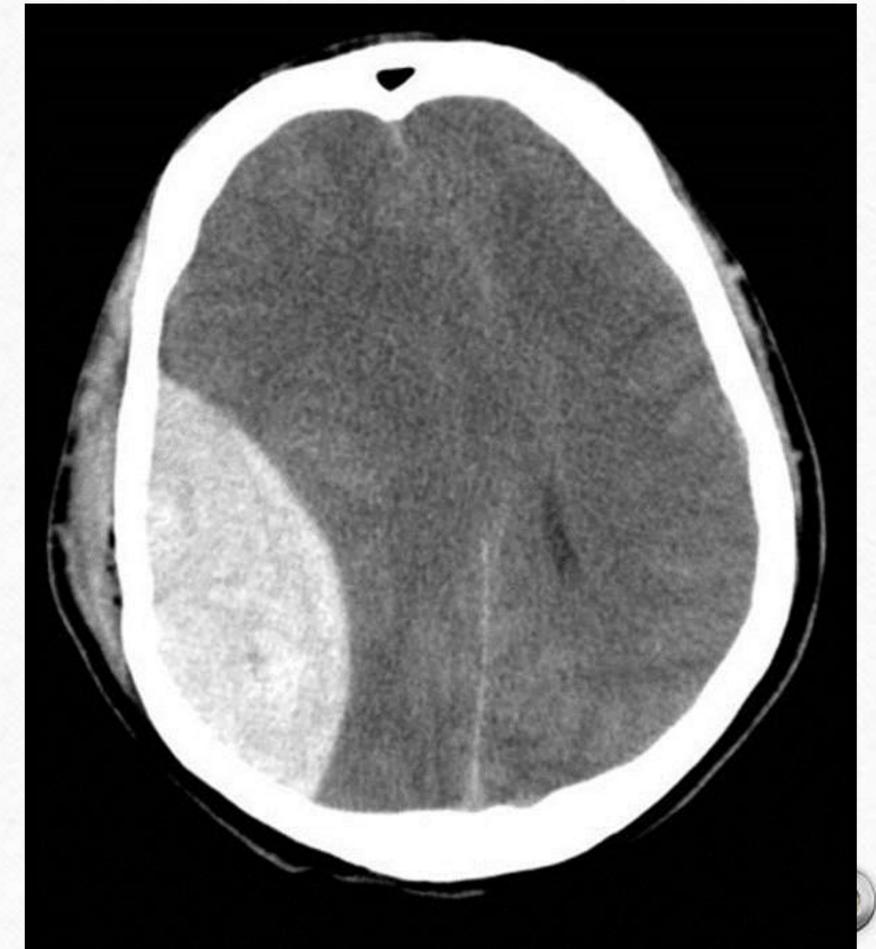
- 1- is the most common cause of prolonged COMA after TRAUMA •
- 2- lesion occur mainly at (Corpous callusum , periventricular white matter , •
Basal gangelia and Brain stem)

COMPLICATIONS

- INTRACRANIAL HAEMORRHAGES :

Acute epidural hematoma

- Accumulation of acute blood in the epidural space (between inner periosteum and dura matter).
- Most commonly appears as a biconvex (lens shaped) , extra-axial hyperdense lesion.
- **Lesion cant cross suture lines**
- EDH can result from injury to the:
 - **middle meningeal artery (main source)**
 - The middle meningeal vein
 - The diploic veins (fractured skull bone).
 - The venous sinuses.



Indications for surgery

- Hematoma maximal thickness > 15 mm.
- Hematoma volume > 30 cc.
- Midline shift > 5 mm.
- Focal neurological deficit caused by the hematoma.



Symptoms

- 1- headache •
- 2- loss of consciousness •
- 3- Lucid interval •

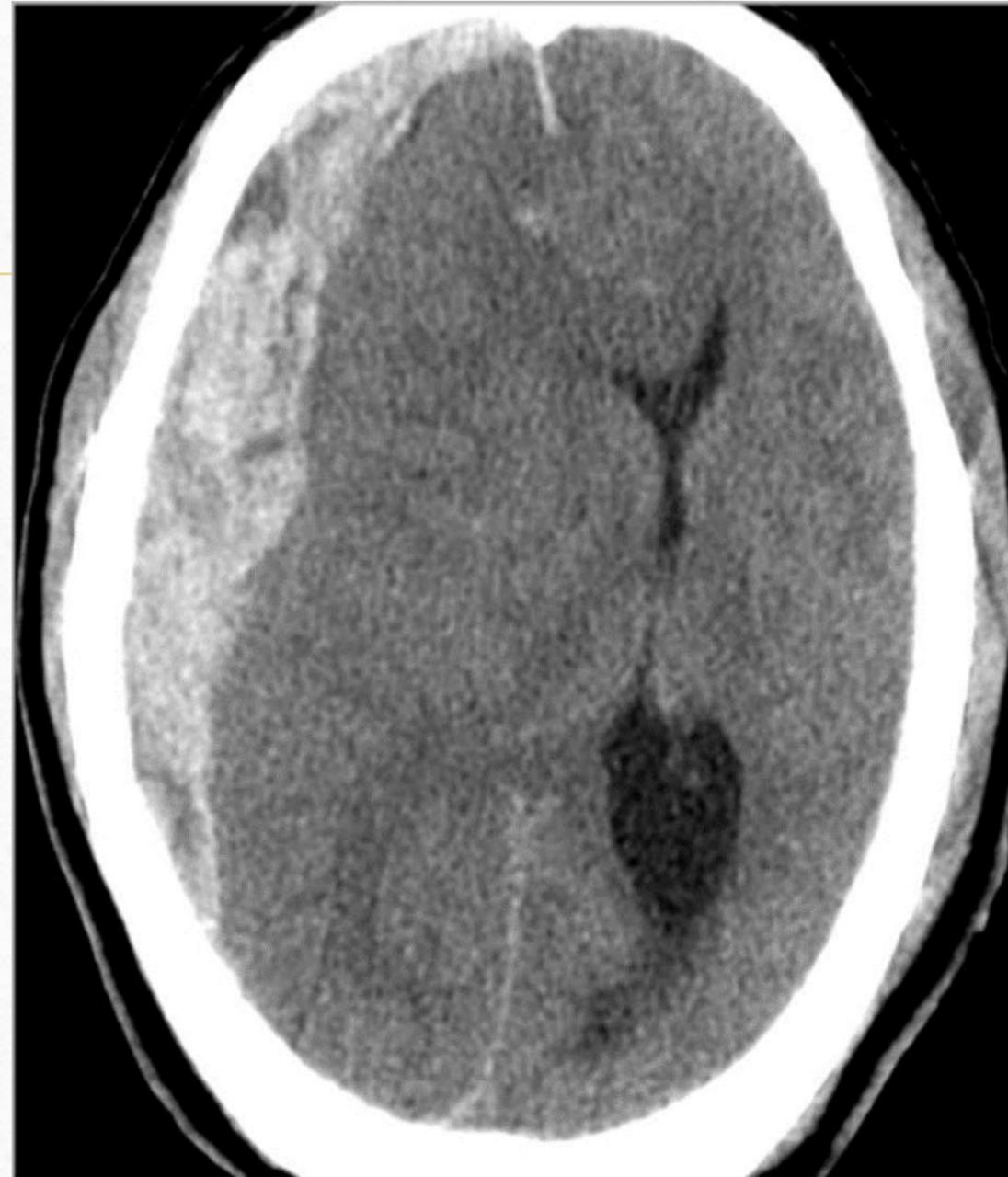
Acute subdural hematoma (ASDH)

- Accumulation of acute blood between the dura matter and the arachnoid matter.
- It is the most common brain hematoma
- It is the most dangerous brain hematoma
- Most commonly appears as a crescent shape, extra-axial hyperdense
- ASDH can result from injury to the:
 - bridging veins (main source)
 - cortical artery.
 - cortical veins.
 - The venous sinuses.



Indications for surgery

- Hematoma maximal thickness > 10 mm.
- Hematoma volume > 30 cc.
- Midline shift > 5 mm.
- Focal neurological deficit caused by the hematoma.



Classic history is confusion weeks after head injury •

•Classic injury in shaken baby syndrome •

SUB ARACHNOID HEMORRHAGE

- Trauma is the most common cause of Subarachnoid hemorrhage
- Bleeding occurs between the arachnoid and pia mater.. SAH may be complicated by hydrocephalus.
- Mostly treated conservatively.
- Usually cortical and unlike aneurysmal subarachnoid hemorrhage.



Thank you