Linear and Depression fractures;

Description, etiology, management, outcome

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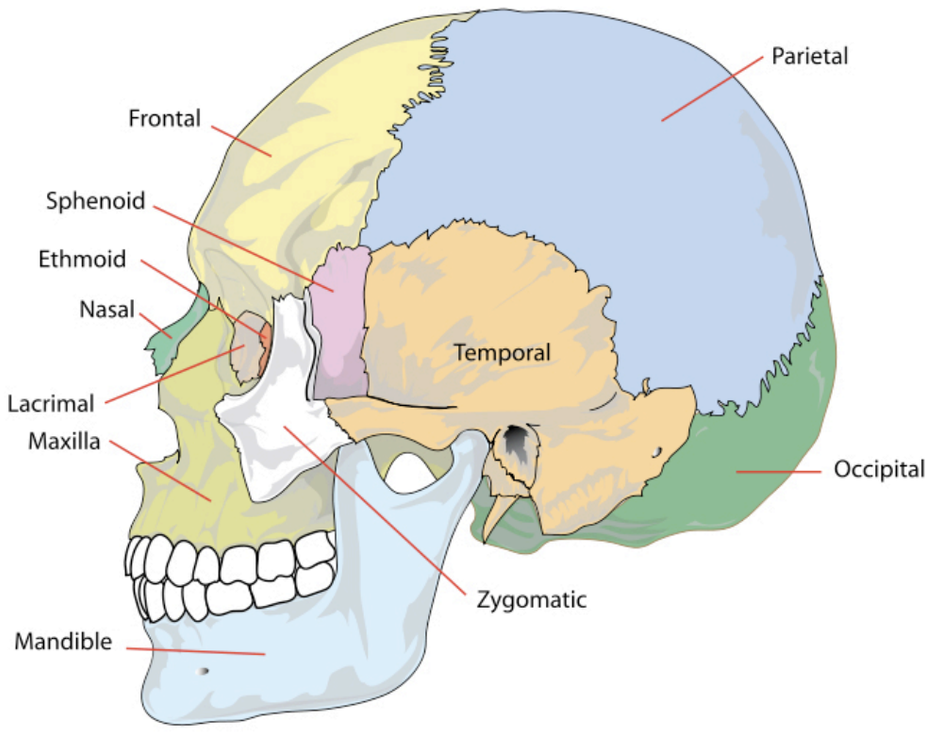
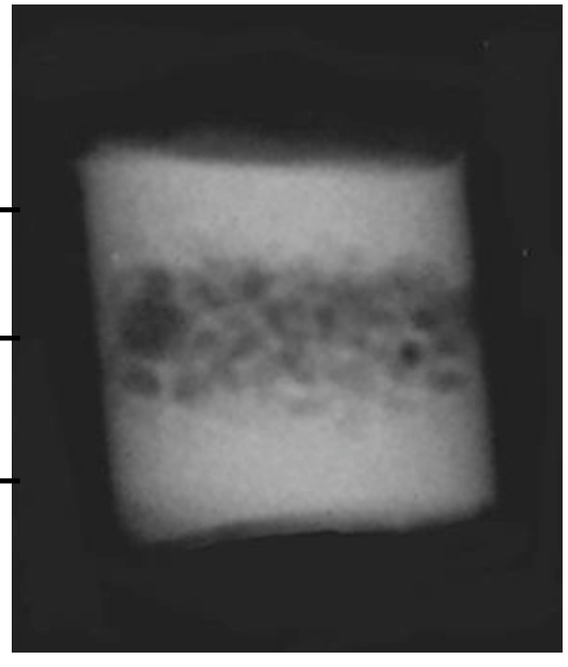
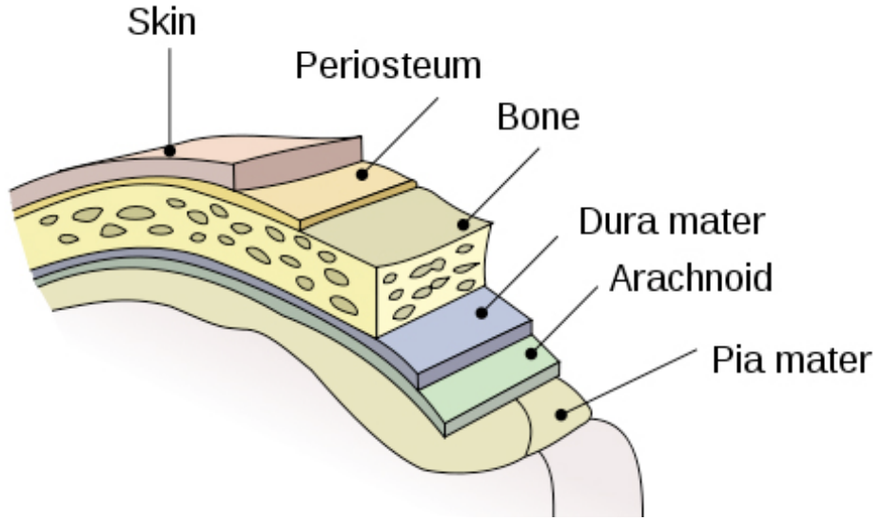
What we know about the skull ?

- Skull contains three layers;



- Lamina externa (compact)
- Diploe (trabecular)
- Lamina interna (compact)





Skull

- **Thick bone sides**
  - Glabella
  - External occipital protuberance
  - Mastoid process
- **Thin bone sides**
  - Where the skull is covered with muscles

Etiology

- In newborns (“ping-pong” depressed fracture)
  - During delivery (Baby’s head impinging against the mother’s sacral promotory)
  - The use of forceps
- In infants
  - Fall, abuse
- In children
  - Fall, bicycle accidents
- In adults
  - Motor vehicle accidents, violence, sport accidents

Signs and symptoms

- Pain, tenderness or swelling at the site of injury
- Contusions, lacerations or hematomas to the scalp
- Deformity of the skull
- Blood or CSF leaking from the ears, nose or mouth (otorrhea, rhinorrhea)
- Bruising around the eyes (raccoon eyes)
- Bruising behind the ears (Battle's sign)

Diagnosis

- Radiographs: In 1987, the skull x-ray referral criteria panel decided that skull films are suboptimal in revealing basilar skull fractures.

- Skull x-ray has no benefit when a CT scan is obtained.

- CT scan: Standard modality, CT reconstructions are useful

- MRI/ MRA: Not in the standard, ancillary value

If CSF leak;

- Tissue paper test : A clear ring around the blood stain (halo sign)

- Biochemistry: Analyzing the glucose level and tau-transferrin (β_2)

Types of skull fractures

- Linear skull fracture
    - Diastatic skull fracture
    - Basilar skull fracture
        - Growing skull fracture
- Depressed skull fracture
- Compound skull fracture

Linear skull fracture

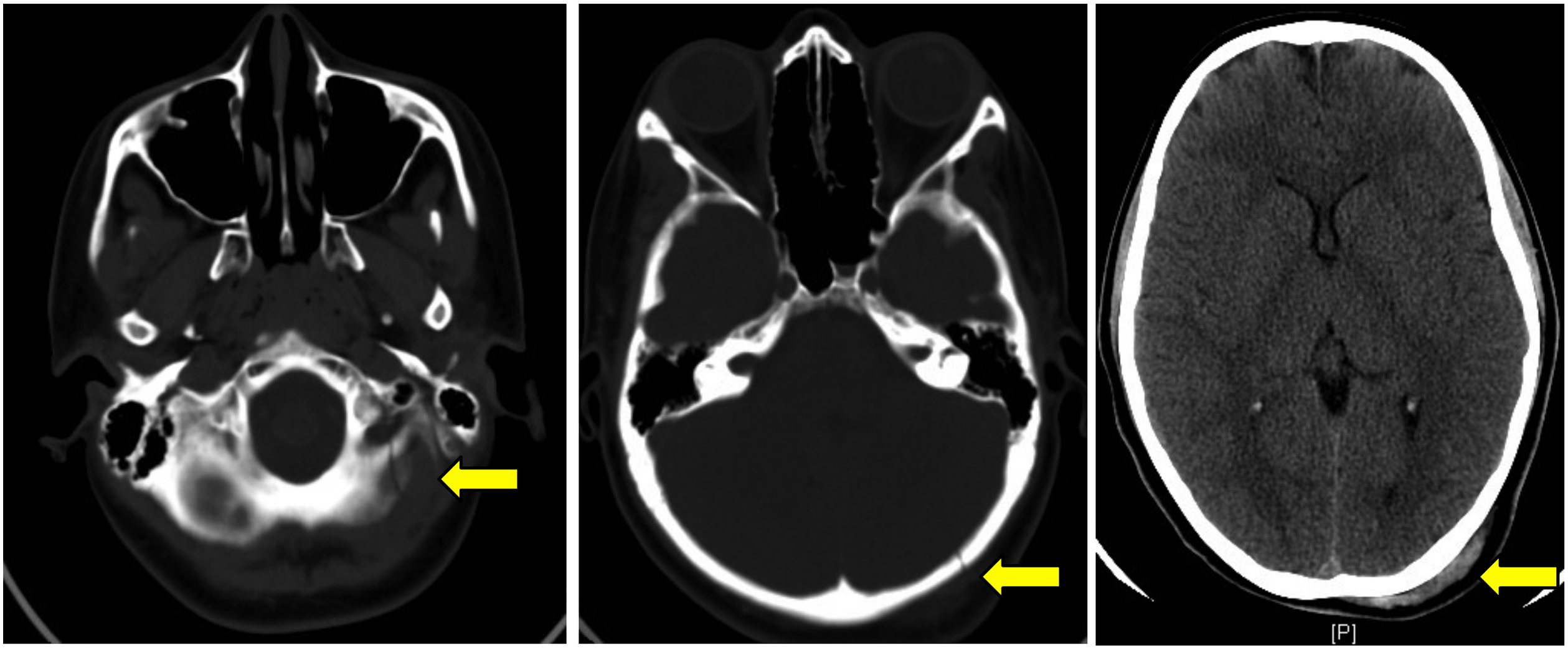
- Fracture line is transverse the full thickness of the skull from the outer to inner table

- No displacement of the bone

- Usually not associate with any neurological sign

- If fracture line is involve suture, venous sinus groove or vascular channel
  - Suture diastasis
  - Epidural hematoma (middle meningeal artery !)
  - Sinus thrombosis
  - Growing fracture in young kids !

Linear skull fracture



Occipital fracture

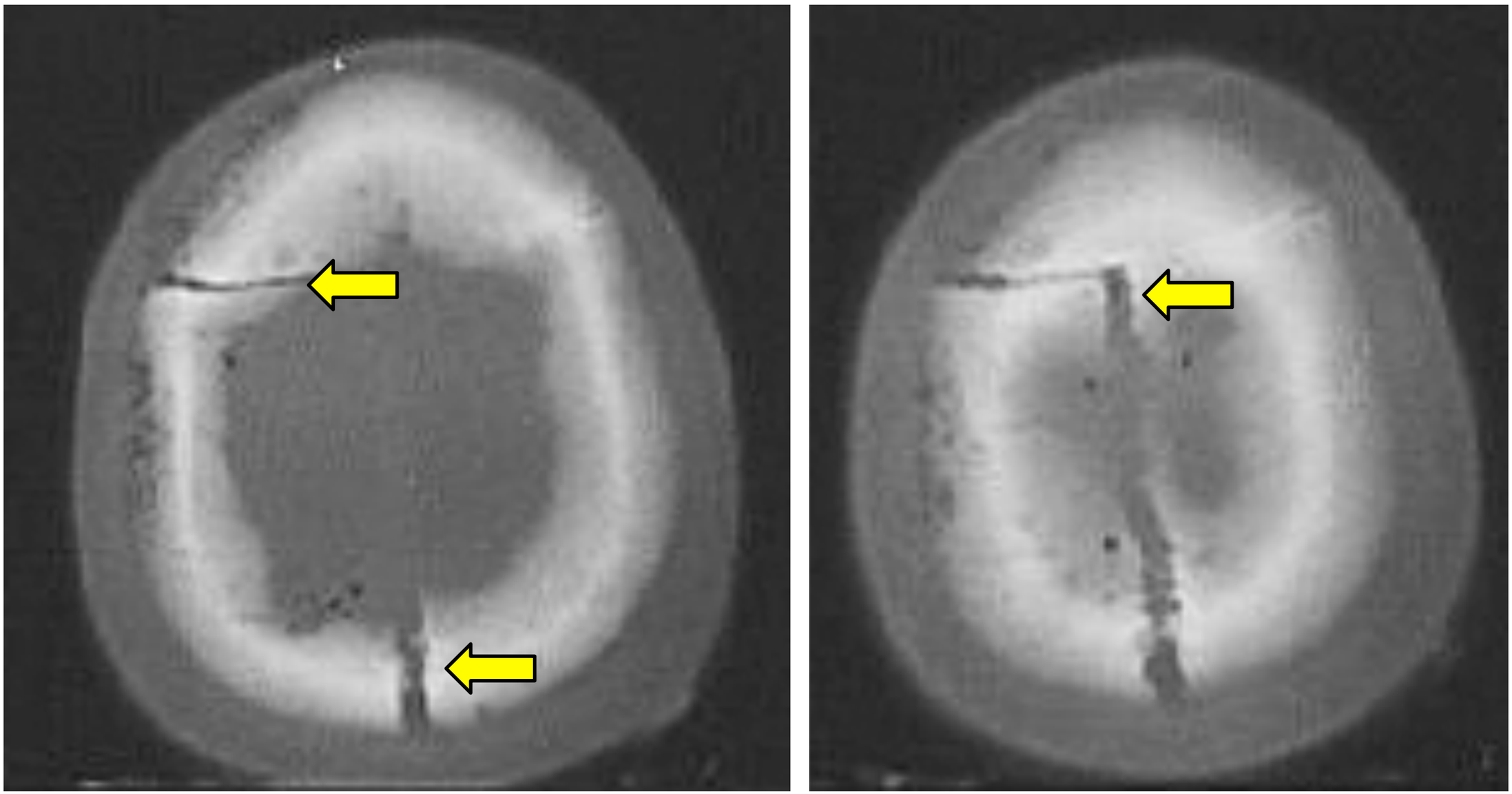
Diastatic fracture

- The fracture line transverses one or more sutures of the skull causing a widening of the suture

- Usually seen in infants and young children as the sutures are not yet fused

- In adults it usually affects the lamboidal suture

Diastatic fracture

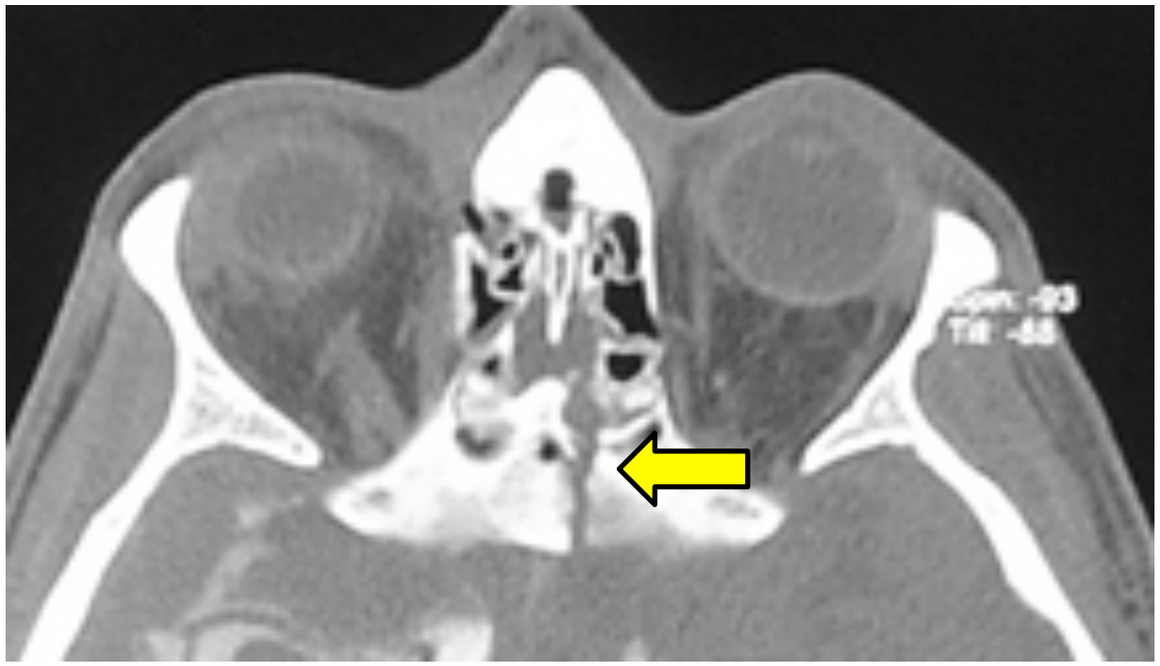


Diastasis of coronal and sagittal sutures

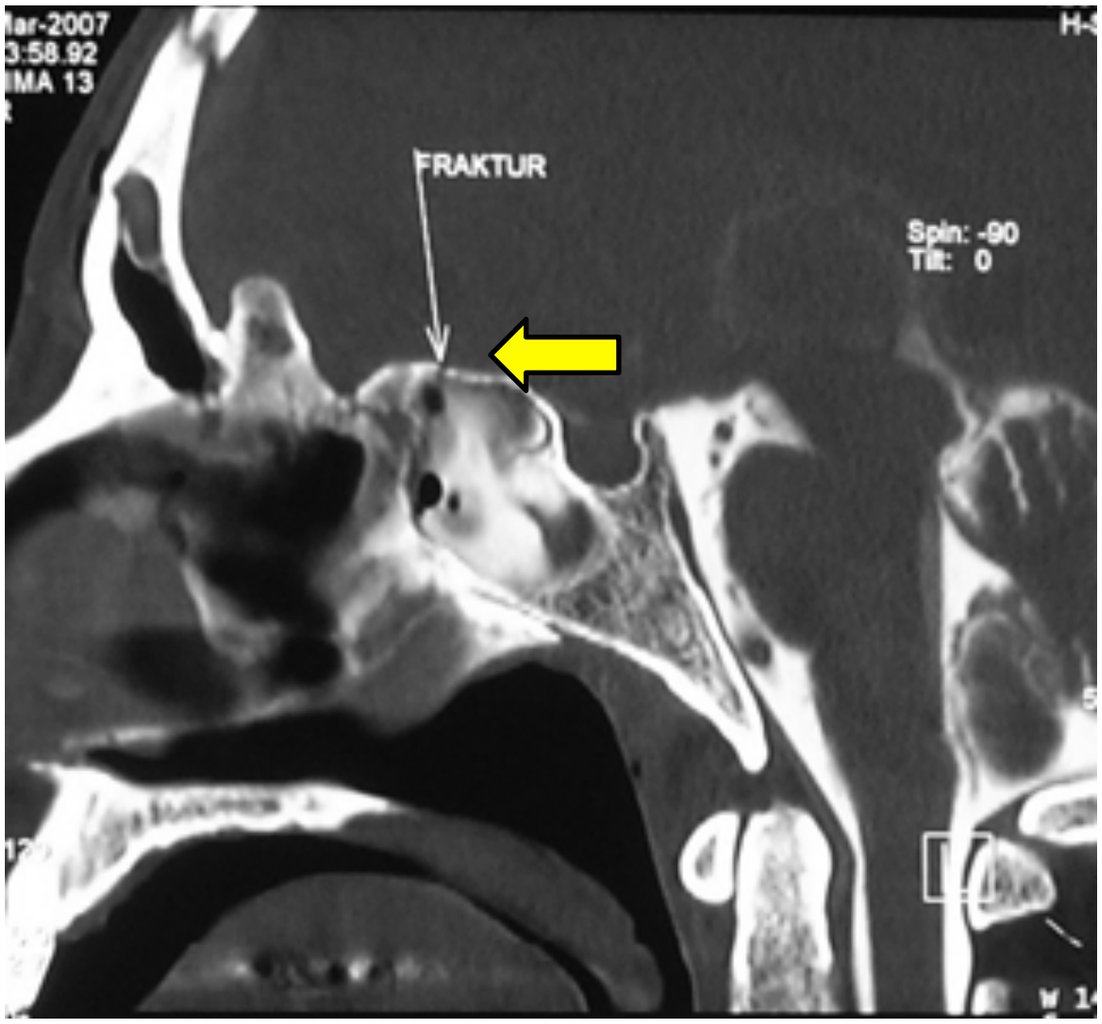
Basilar skull fracture

- Linear fractures occur in the floor of the skull
- Require more force to cause than other areas of the cranium
- Blood may be seen in the paranasal sinuses
- Rhinorrhea, otorrhea, periorbital ecchymosis (raccoon eyes), retroauricular ecchymosis (Battle’s sign)

Basilar skull fracture



Fracture at the ethmoidal cells

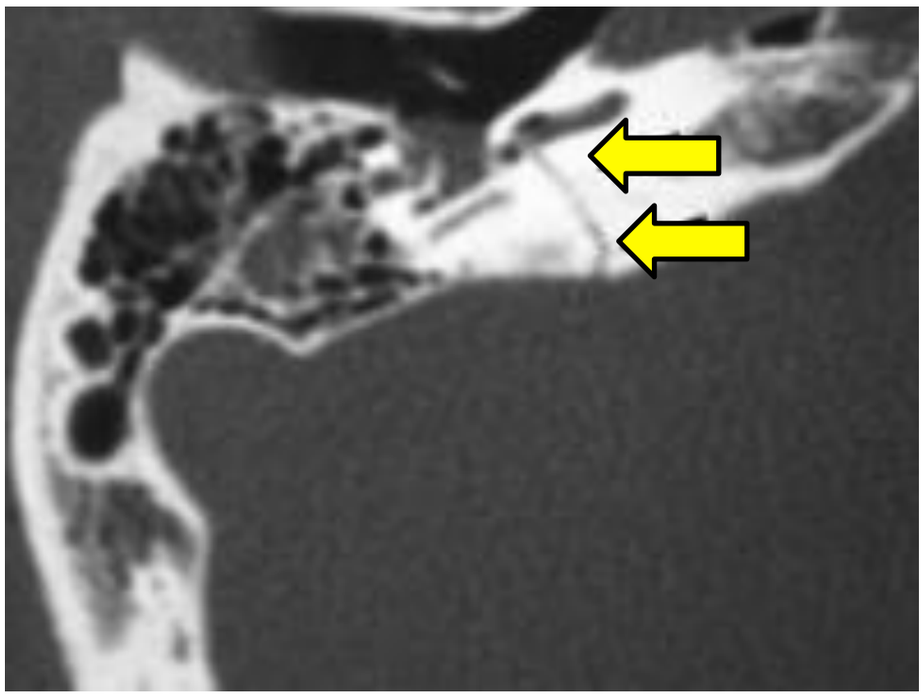


Fracture at the anterior fossa

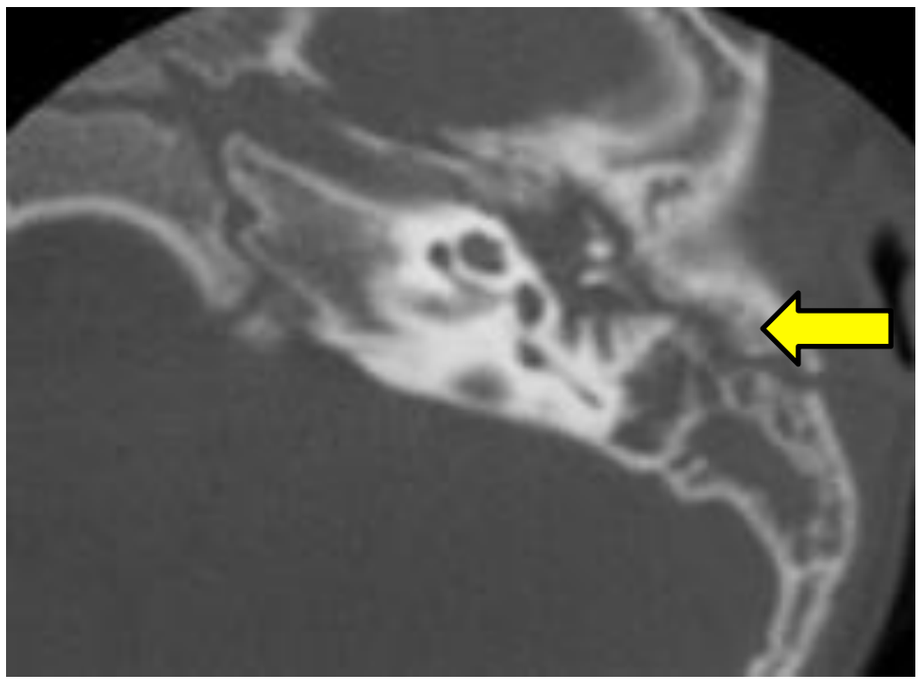
Basilar skull fracture

- Fractures of the petrous temporal bone
  - Ossicular chain disruption and conductive deafness (temporary)
- Transverse temporal bone fractures
  - VII nerve palsy (facial paralysis)
  - VIII nerve palsy (nystagmus, ataxia, permanent hearing loss)
- Occipital condylar fracture (type III)
  - Lower cranial nerve palsy
  - Cervical spine injury

Basilar skull fracture



Transverse temporal fracture



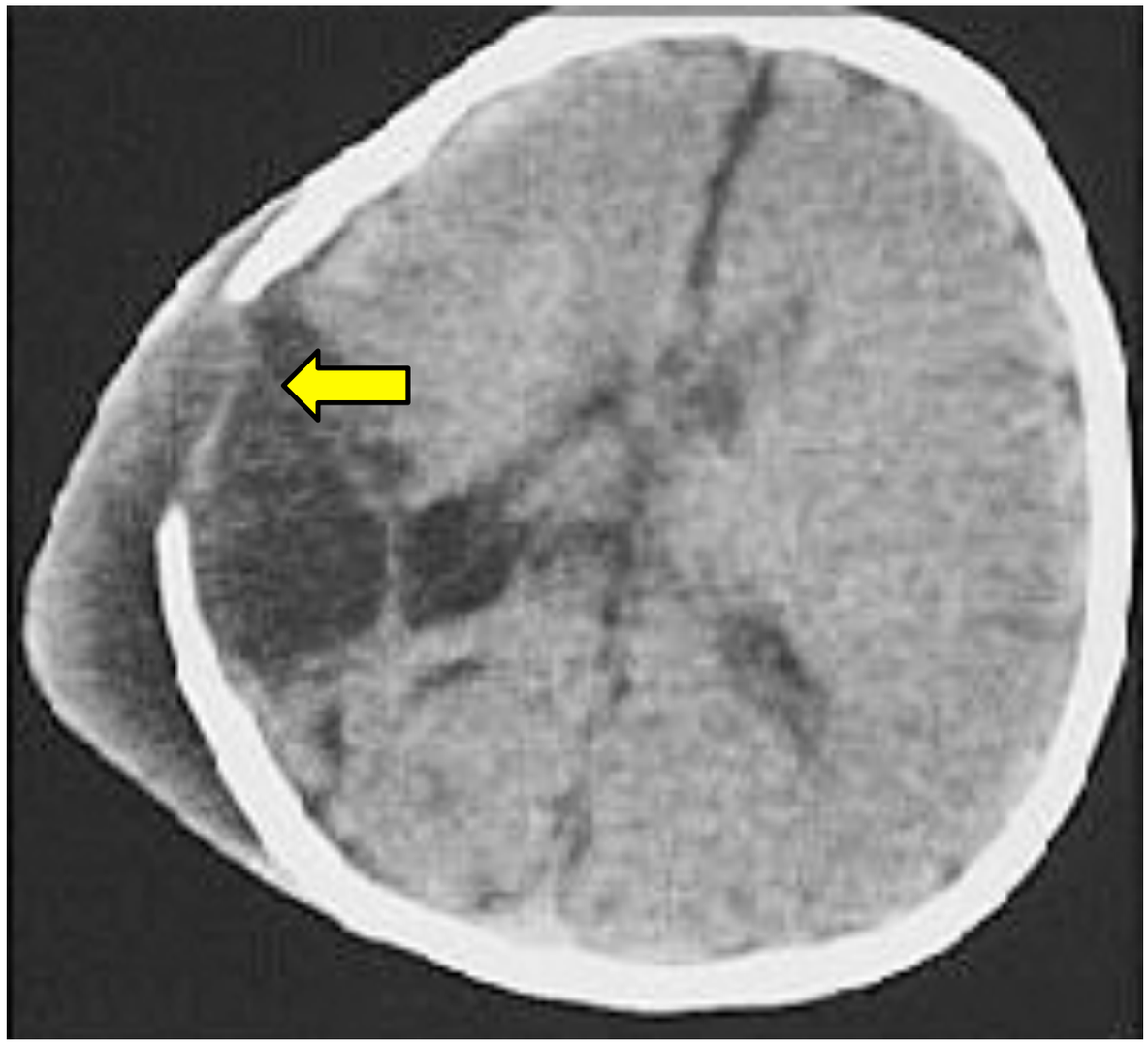
Longitudinal temporal fracture

Growing skull fracture

- Usually associated with linear skull fractures of the parietal bone in children under 3

- A diastatic enlargement of the linear fracture line with CSF accumulation outside of the skull

Growing skull fracture



Growing fracture at the parietal bone

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Depressed skull fracture

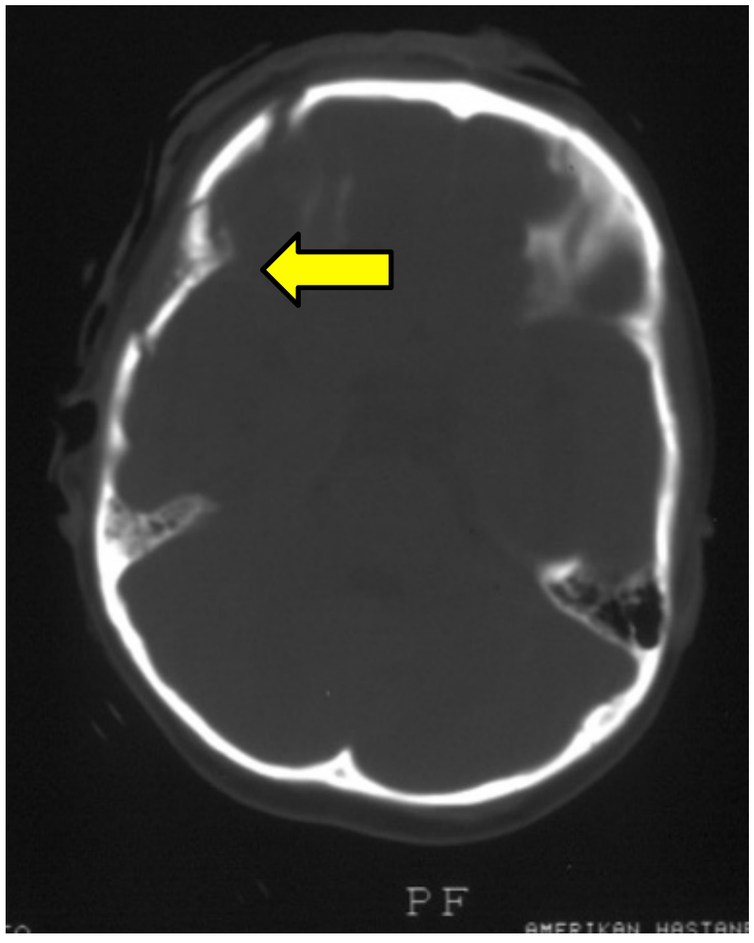
- Broken outer layer is displaced inwardly to the inner layer place or more deeply

- A high risk of increased pressure on the brain

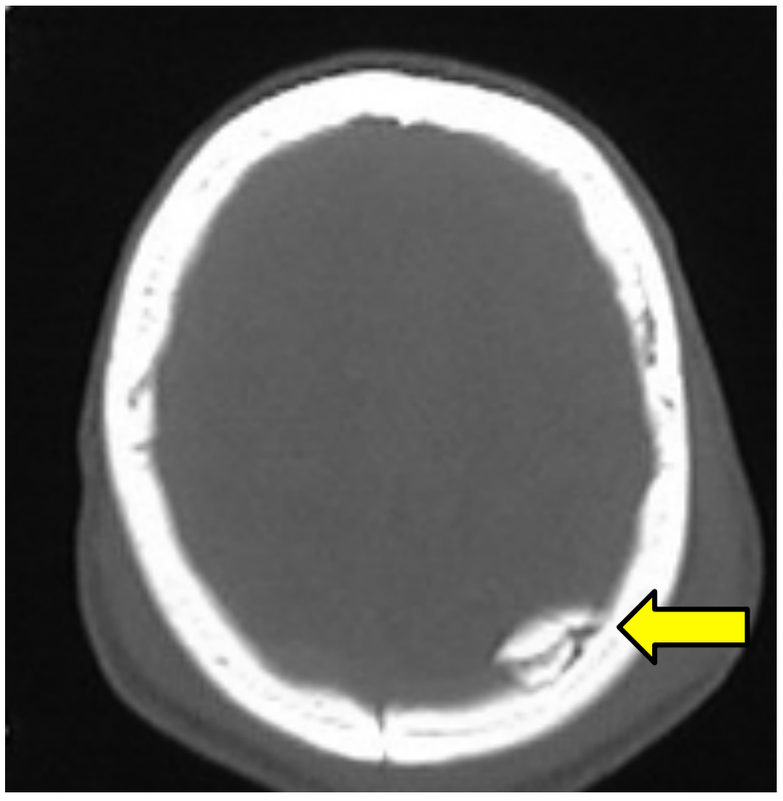
- Dural tear risk

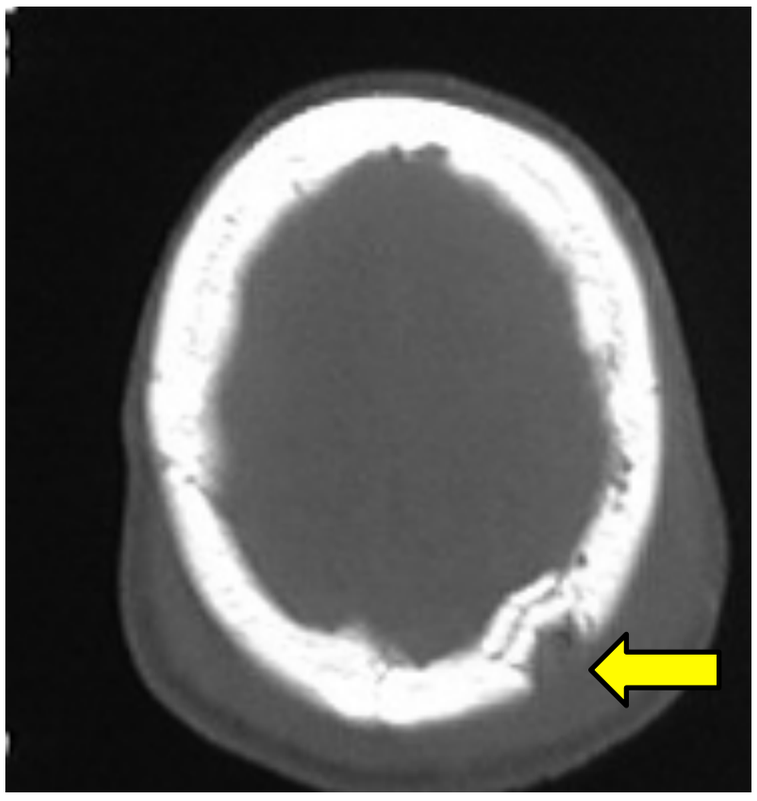
- It can associate with subdural or intracerebral hematoma

Depressed skull fracture



Depressed fracture
at the temporal bone





Depressed fracture at the parietal bone

Compound skull fracture

- A fracture occurs in conjunction with an overlying laceration which tears the epidermis and the meninges or runs through the paranasal sinuses and the middle ear structures

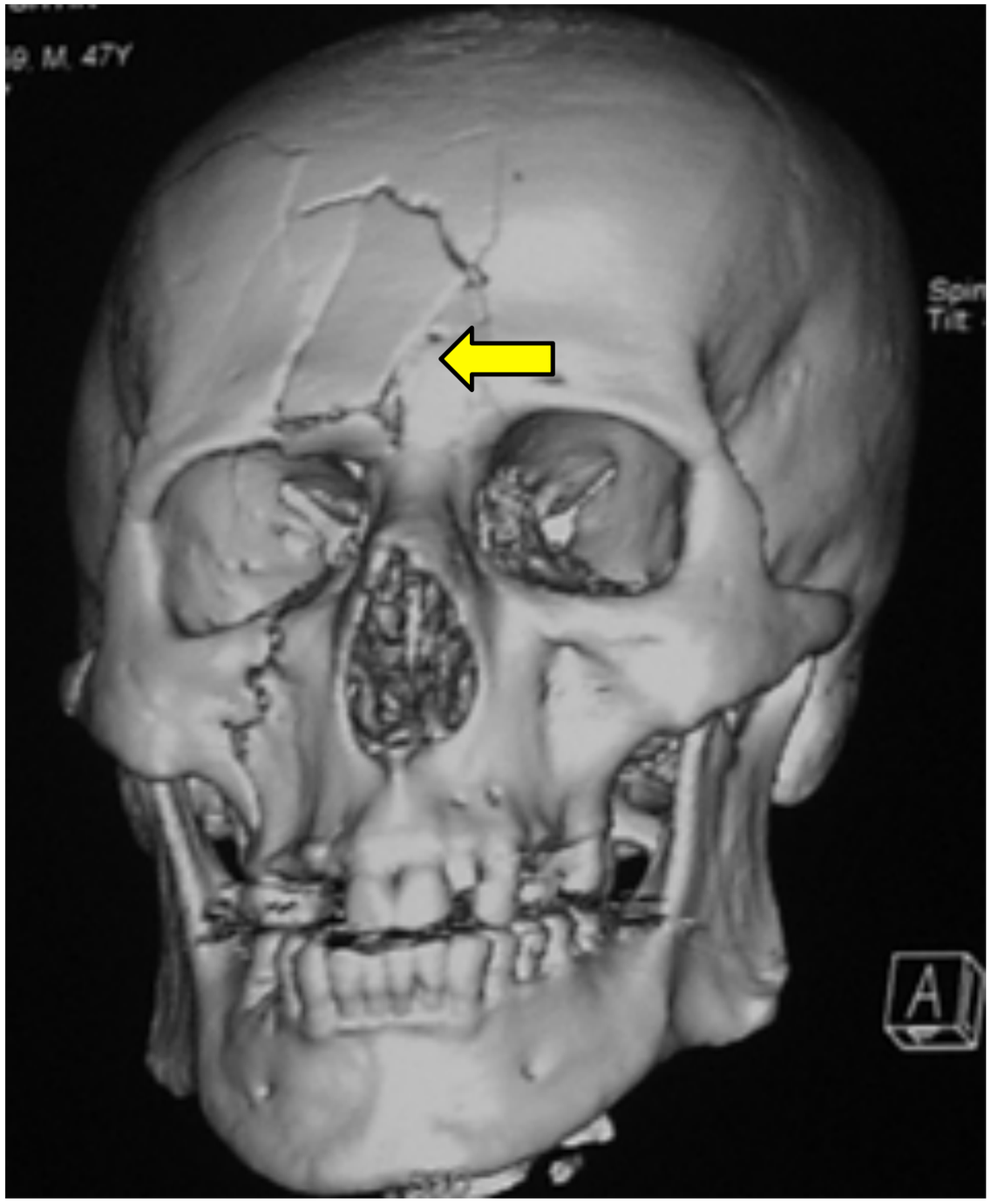
- The outside environment being in contact with the cranial cavity

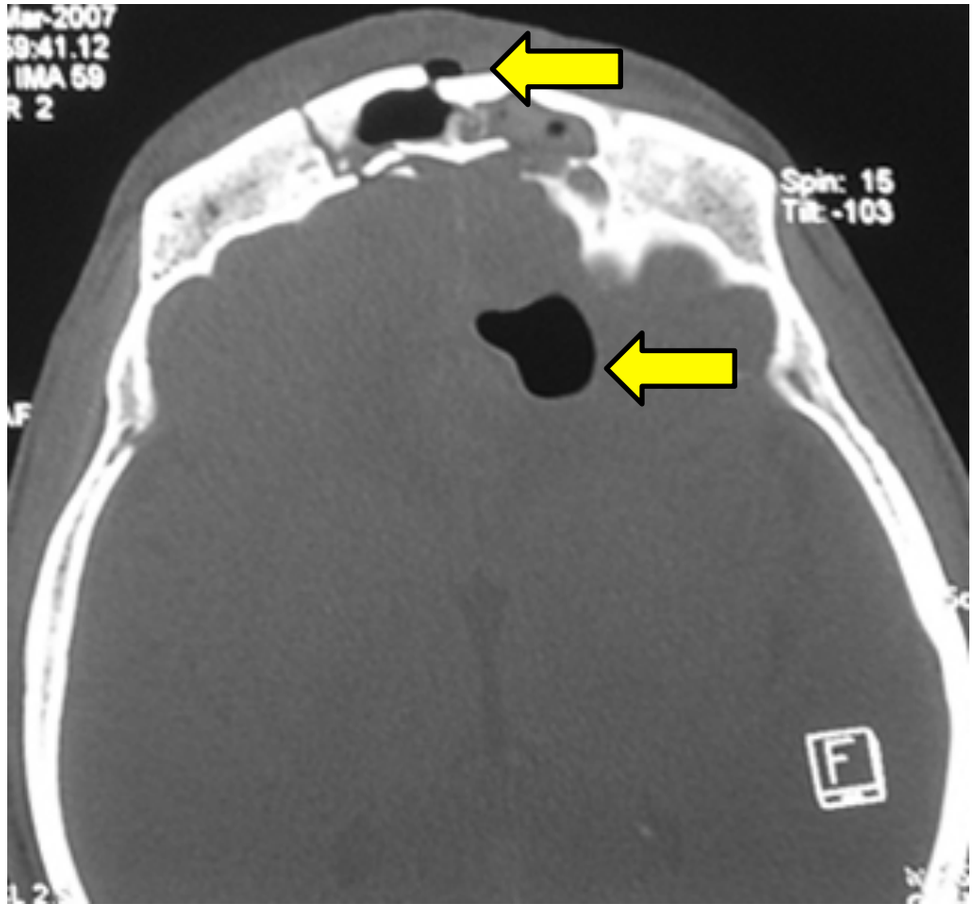
- Compound fractures may either be clean or contaminated

- The most serious complication is infection

- Pneumocephalus may occur

Compound skull fracture





Compound fracture at the frontal bone

Treatment

CONSERVATIVE

- Adults with simple linear fractures who are neurologically intact
- Infants with simple linear fractures should be admitted for overnight observation regardless of neurological status
- Temporal bone fractures with tympanic membrane rupture usually heals on its own
- Simple depressed fractures in neurologically intact infants

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- Head elevation for cases with otorrhea or rhinorrhea
- Cervical collar for occipital condyle fractures (type I and II)

Treatment

MEDICAL

- Open fractures, if contaminated, may require antibiotics in addition to tetanus toxoid

- Seizure medications are recommended if the chance of developing seizures is higher than 20%

- Otorrhea, rhinorrhea might not need antibiotic prophylaxis

Treatment

SURGICAL

- Open depressed fractures
- Elevate depressed skull fractures; if the depressed segment is more than 5 mm below the inner table of adjacent bone
- Craniotomy may be performed if there is dural tear or hematoma
- Craniectomy may be need if the underlying brain is damaged and swollen
- Unstable condyle fracture (type III) needs stabilization procedure
- If CSF leakage do not heal with conservative treatment or spinal drainage

Prognosis/ Outcome

- In infants and children, a simple linear fracture, if associated with a dural tear, can lead to a growing skull fracture. (This may take up to 6 months to develop)

- The risk of infection is not high even without routine antibiotics after basilar skull fracture

- Sudden onset facial palsy at the time of fracture usually with poor prognosis

- If facial palsy starts with a 2- to 3-day delay is responsive to steroids

- Lower cranial nerves (IX, X, XI, and XII) may be involved in occipital condylar fractures

Prognosis/ Outcome

- The chance of a concomitant cervical spine injury is 15%

- Sphenoid bone fracture may affect the III, IV, and VI cranial nerves and also may disrupt the internal carotid artery and potentially result in pseudoaneurysm formation and caroticocavernous fistula

- The overall risk of seizures after depressed fracture is low but is higher;
  - if the patient loses consciousness for longer than 2 hours,
  - if an associated dural tear is present,
  - if the seizures start in the first week of injury

Thank you