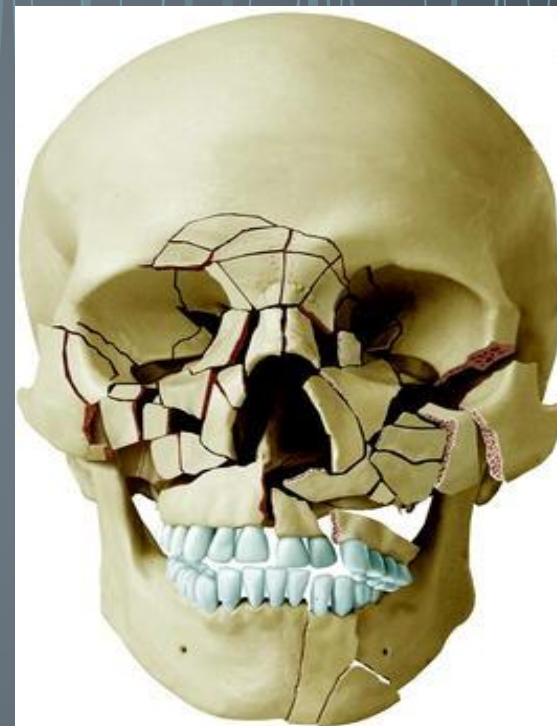




IMAGING of CRANIOFACIAL TRAUMA



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RADIOLOGY DEPARTMENT

SEBELAS MARET UNIVERSITY – MOEWARDI GOVERNMENT HOSPITAL

2025

OUTLINE

○ Craniofacial anatomy

○ Orbital Fracture

○ Frontal Fracture

○ Zygoma Fracture

○ Nasal Fracture

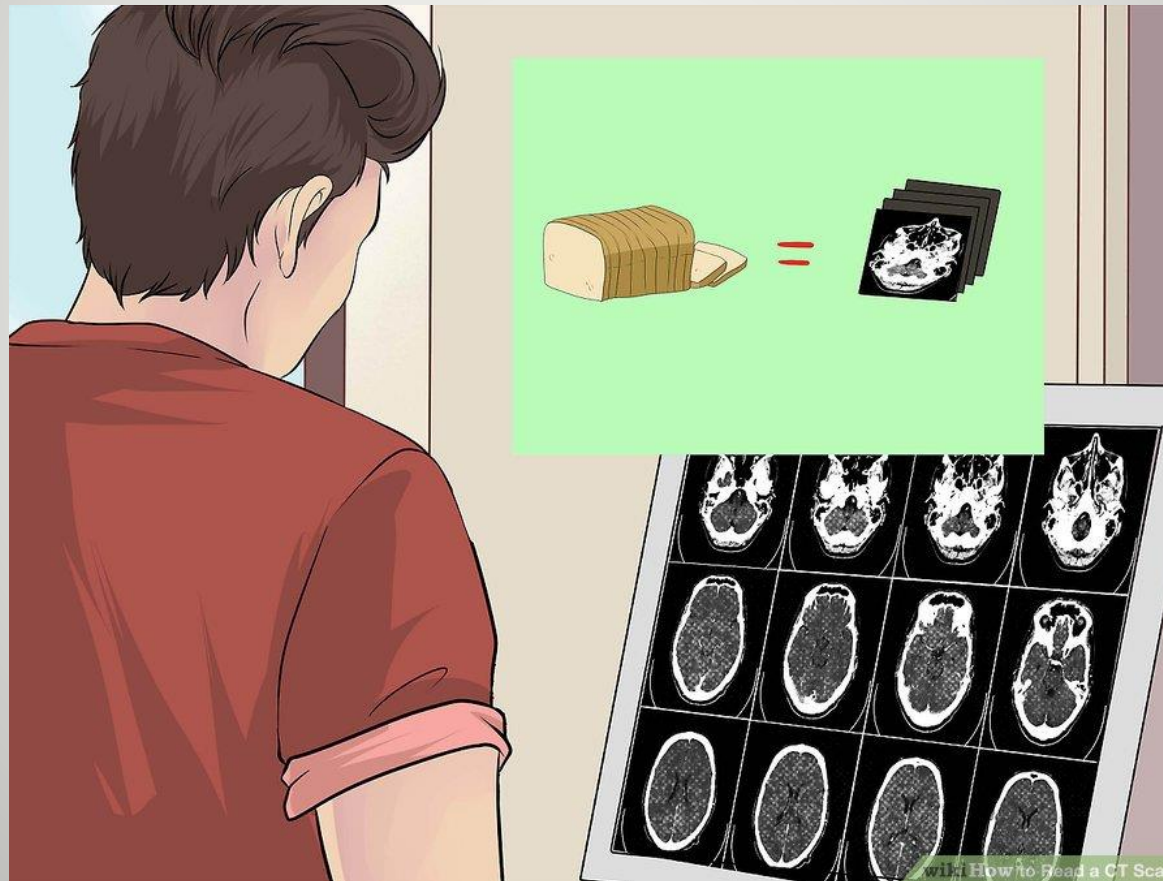
○ NOE Fracture

○ Maxilla Fracture

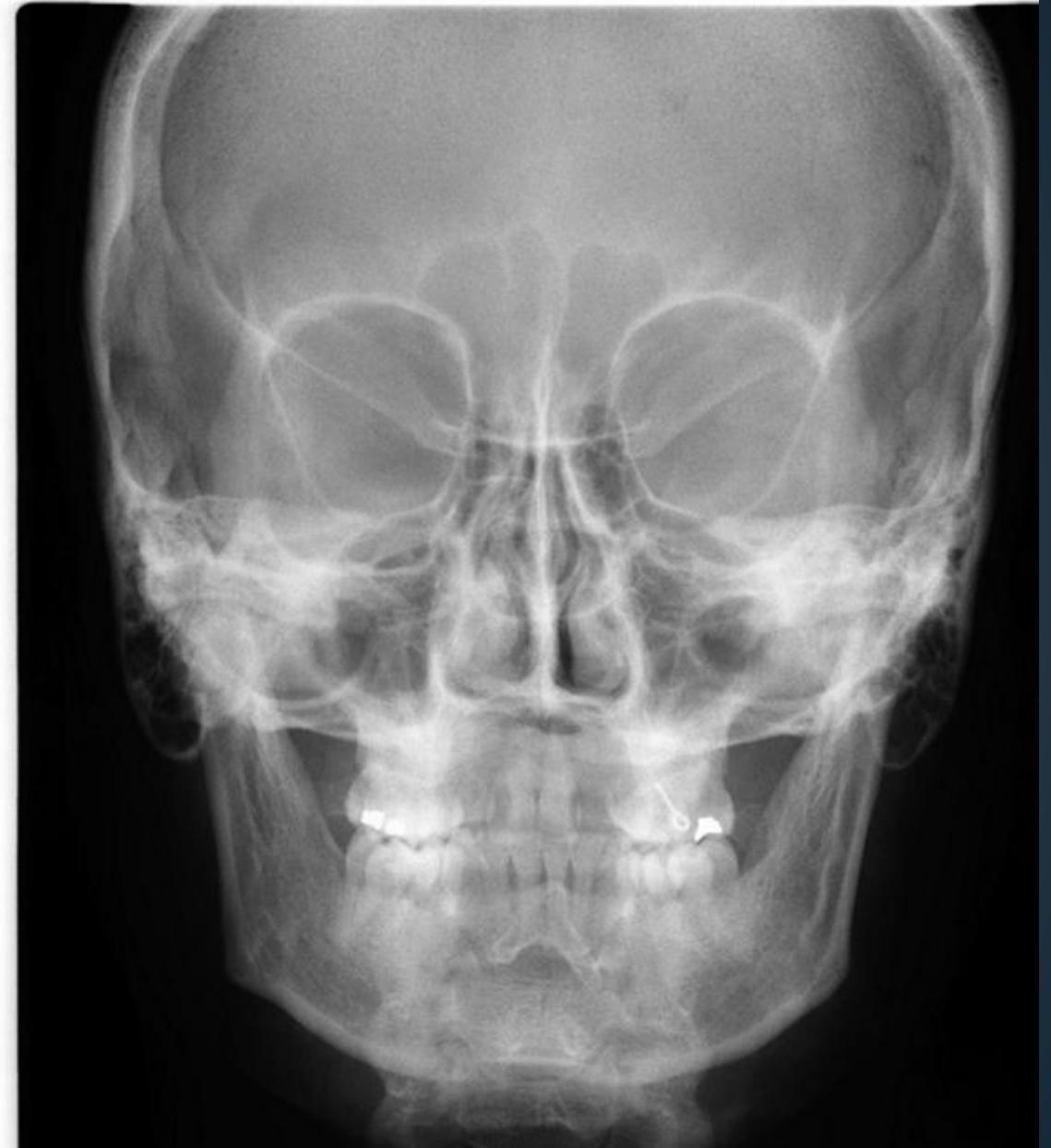
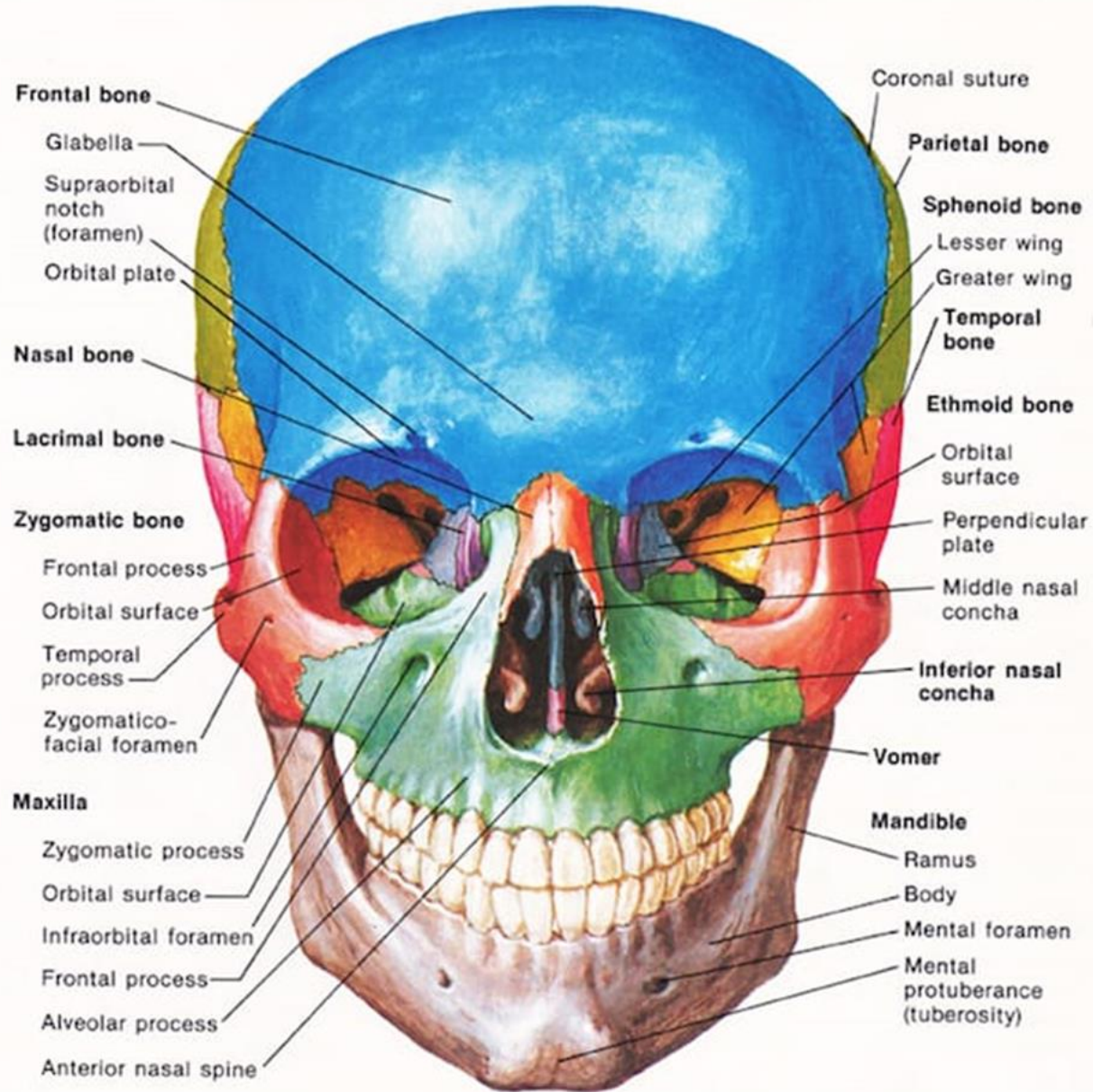
○ Mandibula Fracture

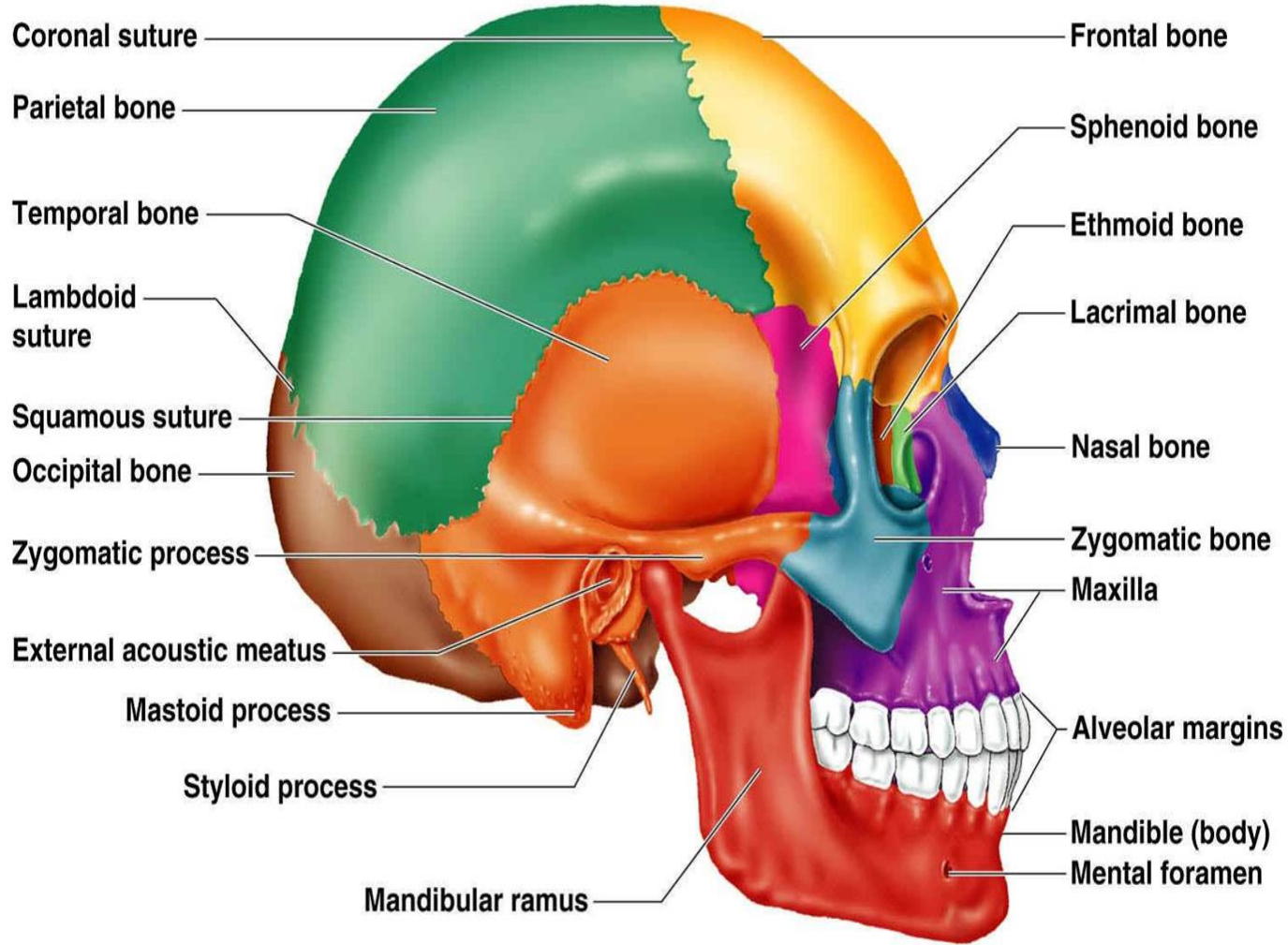
○ Palatum Fracture

CRANIOFACIAL ANATOMY



Anterior Aspect of Skull





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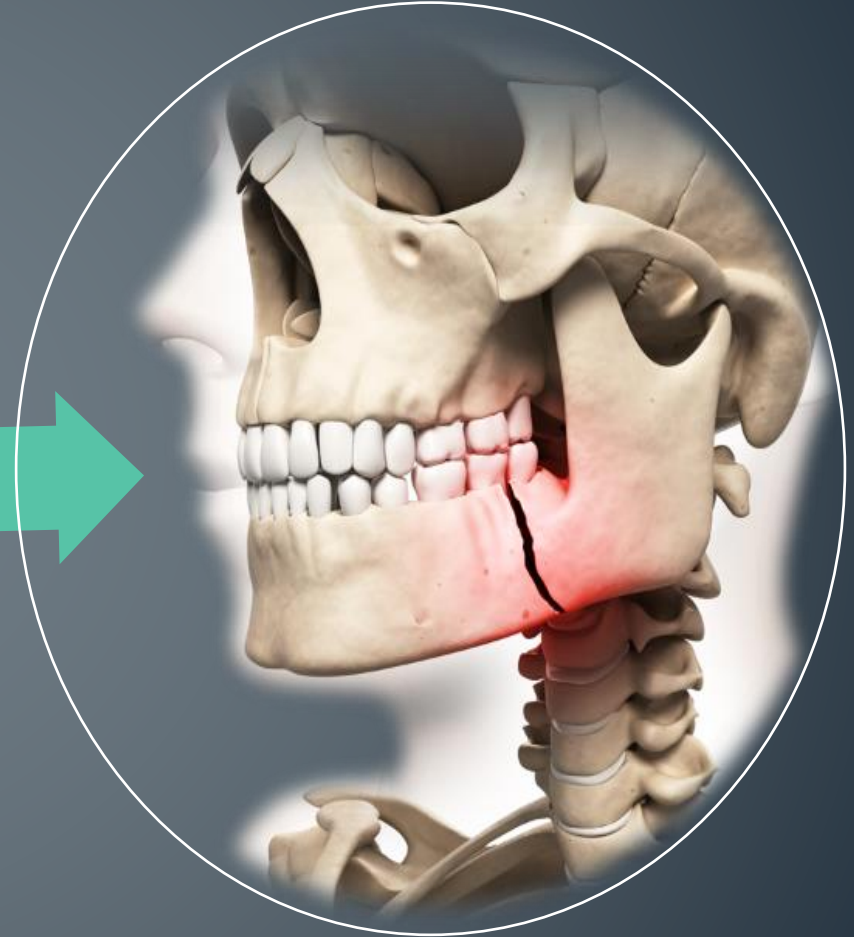
**Maxillofacial
buttress**

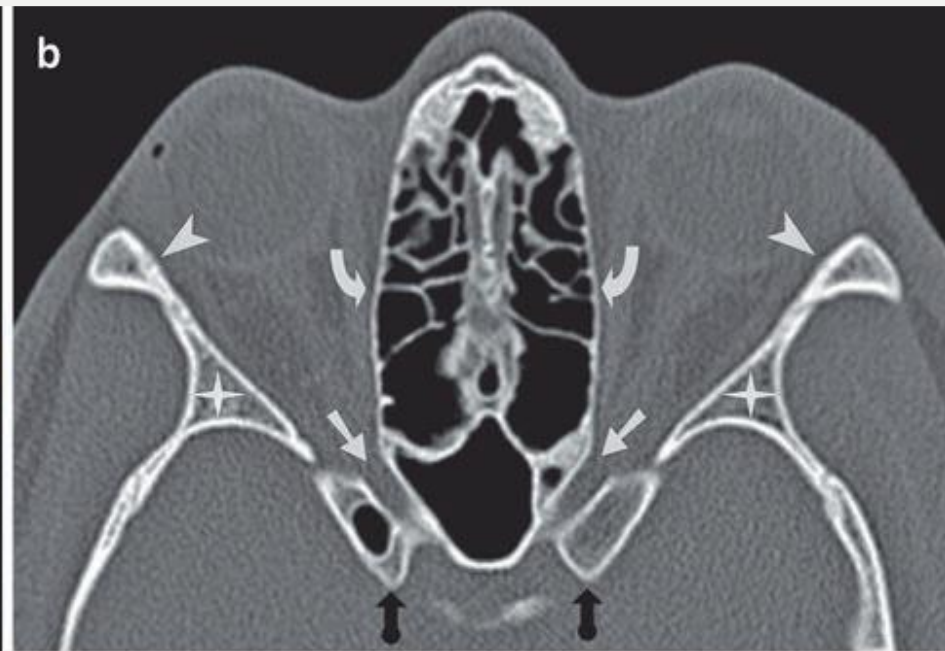
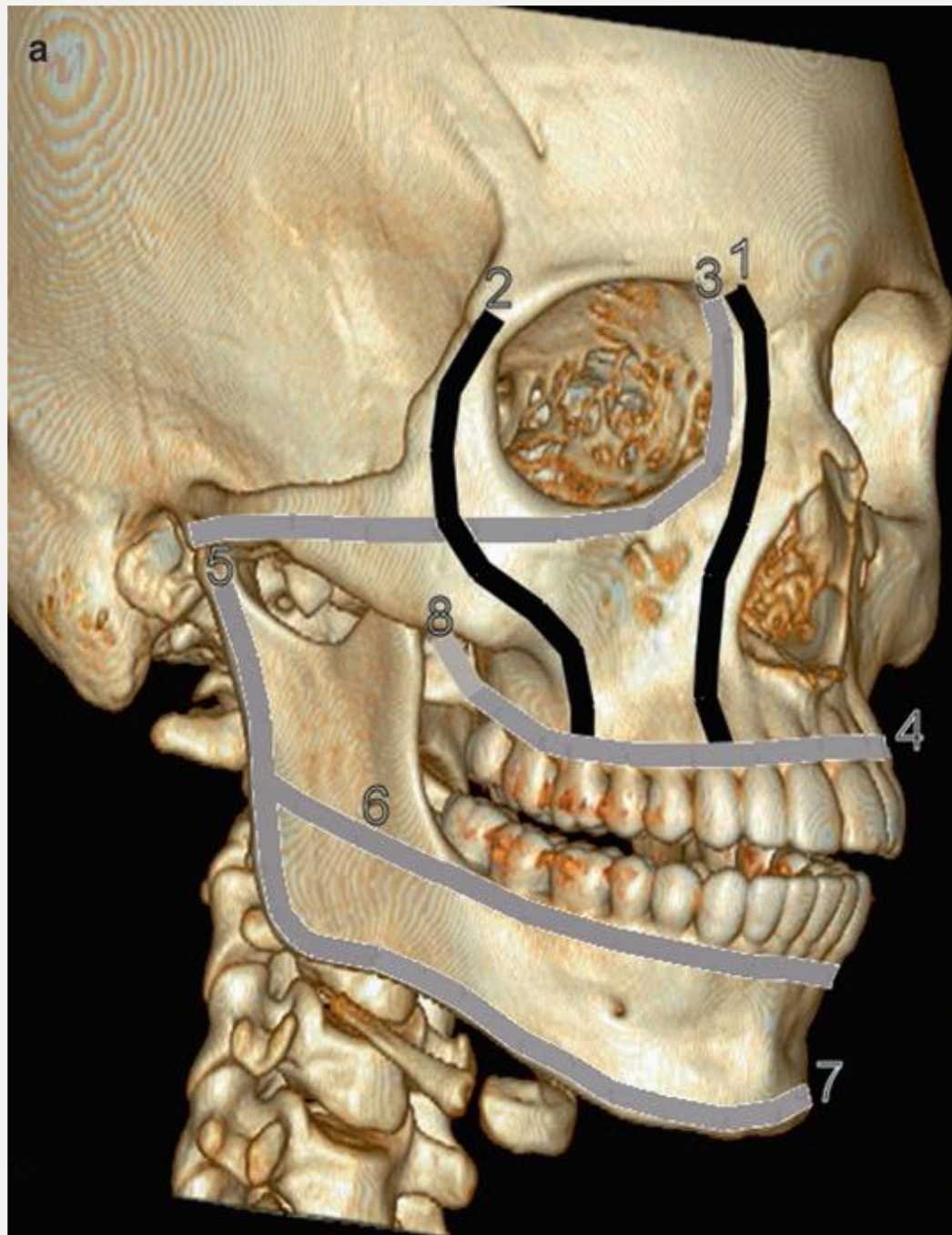
Strength

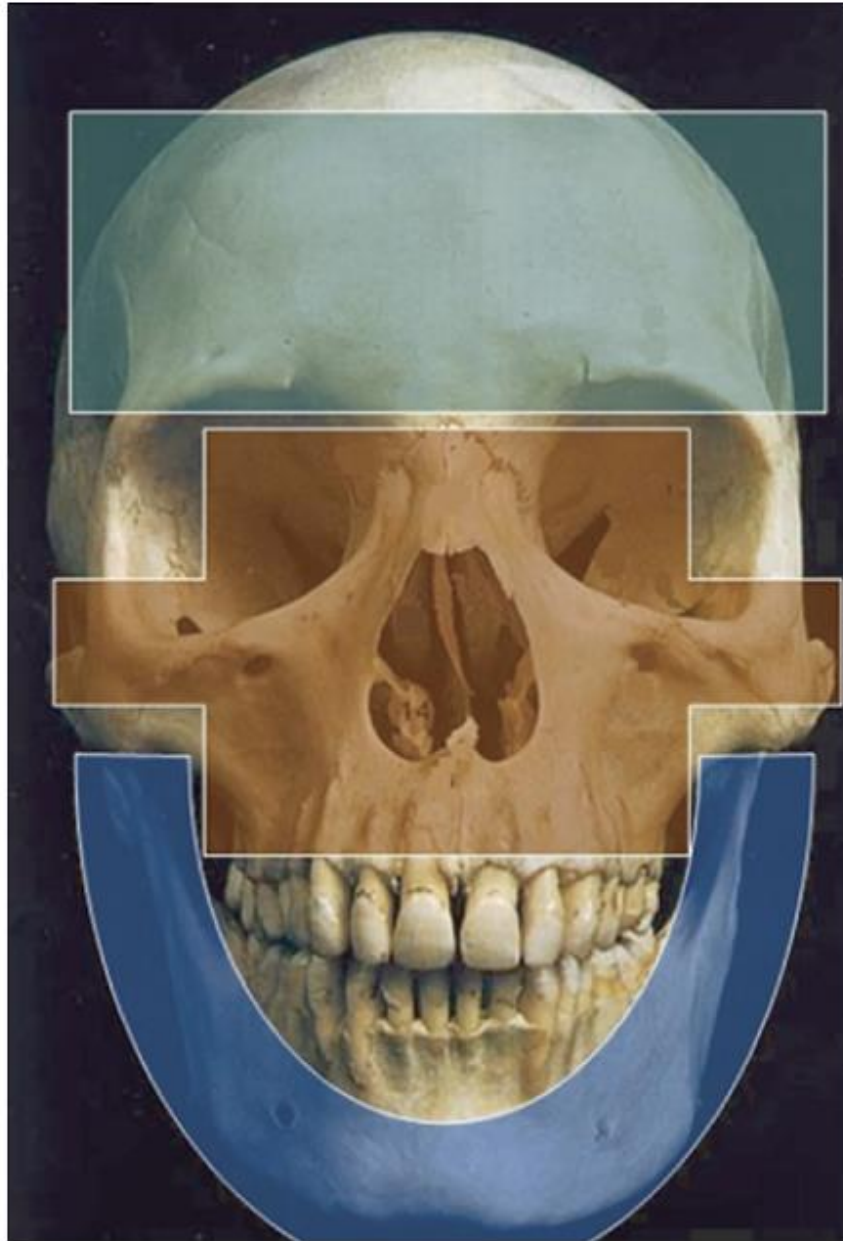


**Sinuses and
sutures**

Weakness







Upper Facial Fractures:
Frontal, Superior Orbit

Middle Facial Fractures:
Other Orbit, Nasal, Zygoma, Le Fort,
Maxillary Sinus, Dentoalveolar

NOE: Medial Orbit + Nasal

ZMC: Zygoma + Maxilla +
Lateral Orbital Wall

Lower Facial Fractures:
Mandible

Radiographic



Entrapment of
vital structures



Occlusal
disharmony



Bone loss



Severity of injury,

Finding :



Displacement
segments,



Isolated fractures to
complex facial injuries



Loss of teeth,

Plain Foto :

Lateral cephalic,
Caldwell's lateral oblique,
Waters' views,
Towne's view,
Cervical spine

CT Scan :

Brain window, Bone window and
3D scanning of the entire skull
extending from the vertex to the
mandibular angle. Slice thickness
of 2.5 mm and slice distance of
less than 1.5 mm

Imaging Modality

CTA :

For traumatic injuries to
pathologic condition such as
vascular malformations or vessel
aneurysms

MRI :

For examination of soft tissue
structures of extracranial head
and neck

Waters' view

Midface and
delineating fractures
of the orbital rims,
Arch zygoma,
Anterior facial



Lateral Cephalic View

- Midface fracture
(LeFort Fractures)
- Nasal fractures)

Lateral Oblique View :

Mandibular angle
and Condyles

SMV view

- Zygomatic arch
- midface fractures

Towne's view

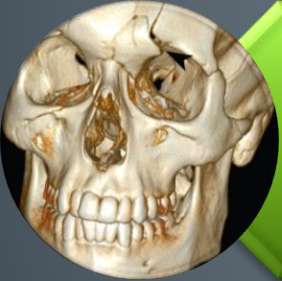
- For subcondylar fracture
- To demonstrate lateral or medial angulation and/or displacement
- Maxillary sinuses and inferior orbital rims → post operative
- PA townes' → petrous ridges, mastoid air cells, foramen magnum, dorsum sellae, os occipitalis



Orbital Fracture



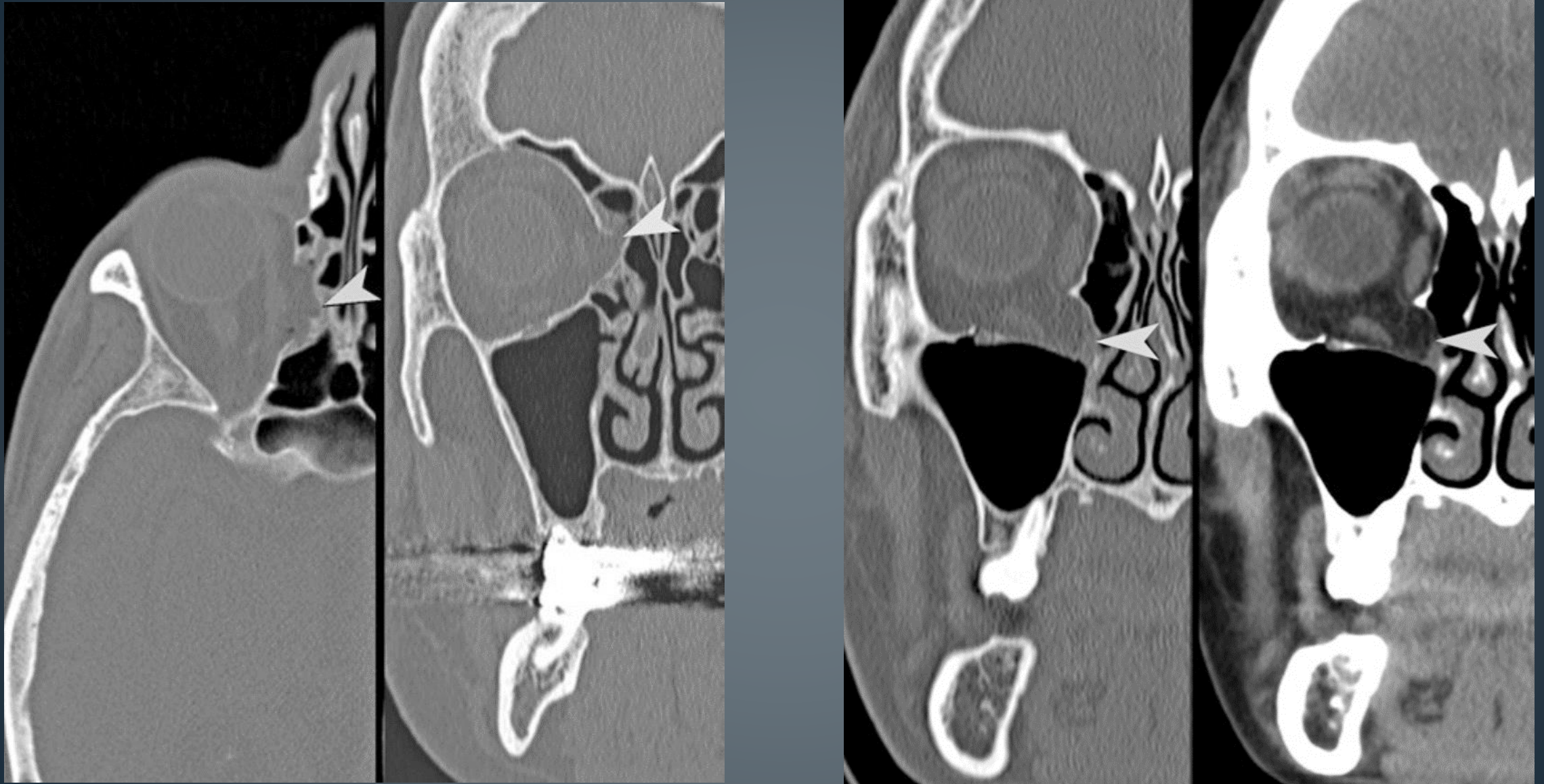
Blow out fracture



Blow in fracture



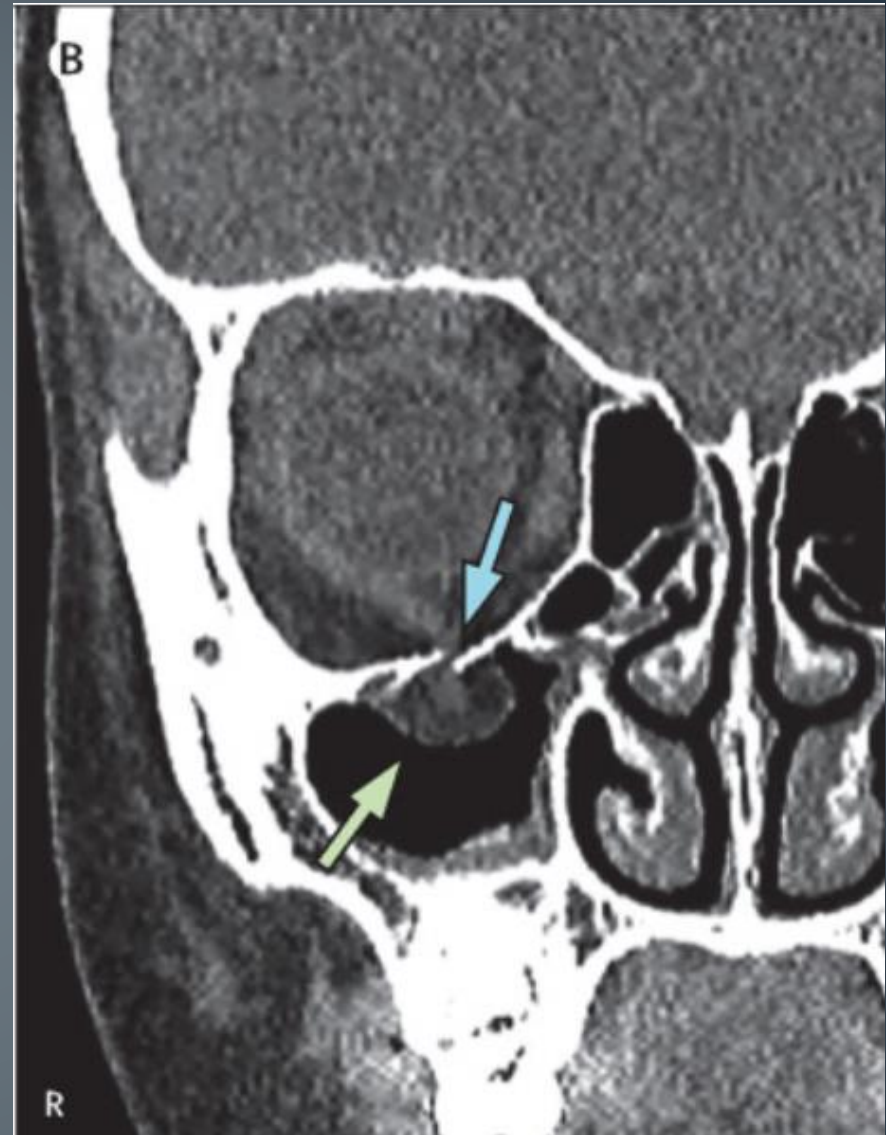
“Trapdoor” blow-out
fracture



Blow Out Fracture



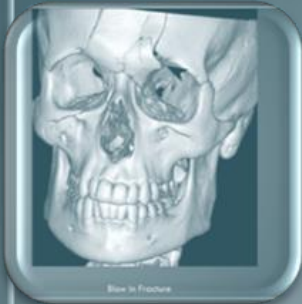
Blow In Fracture



Trap Door Fracture

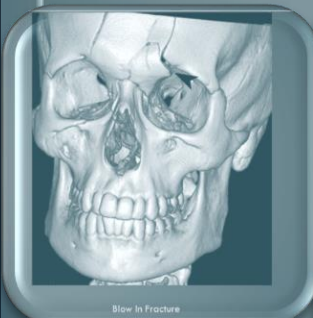
Frontal Fracture

CT is important to evaluate the extent of the fracture and whether it involves the anterior table, posterior table, or both

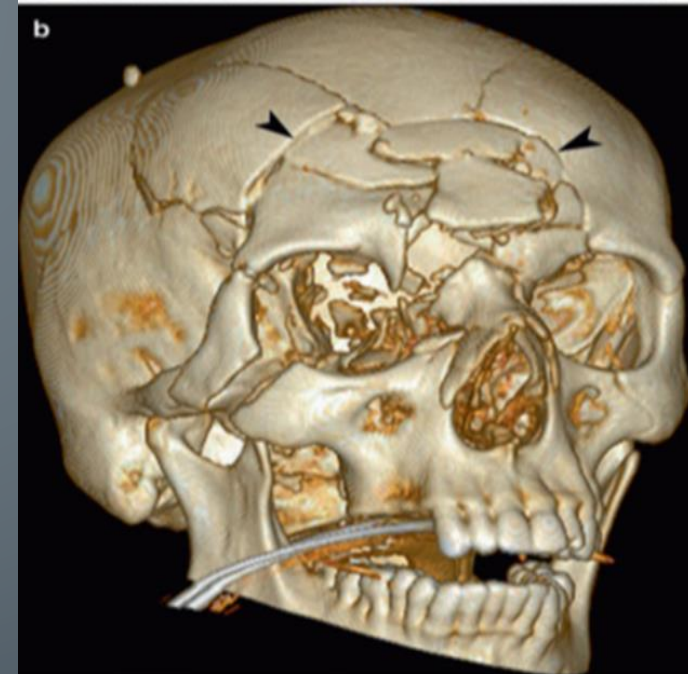
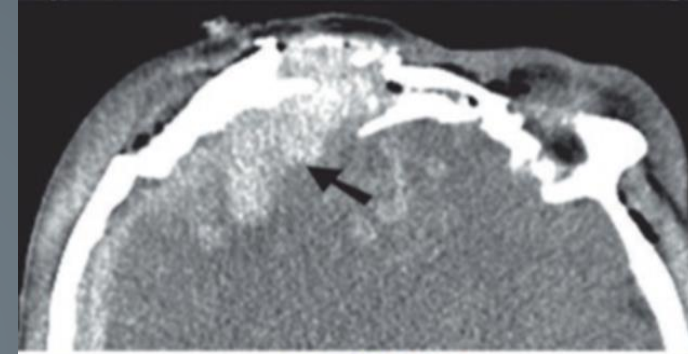
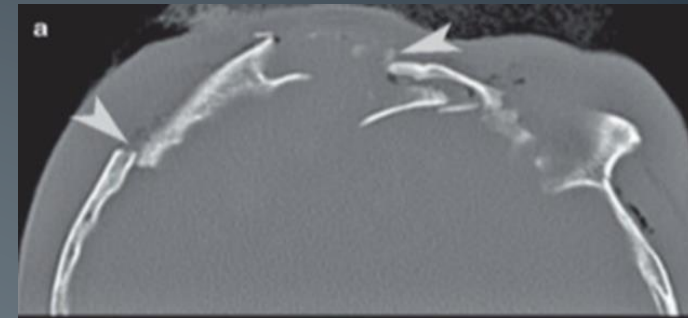
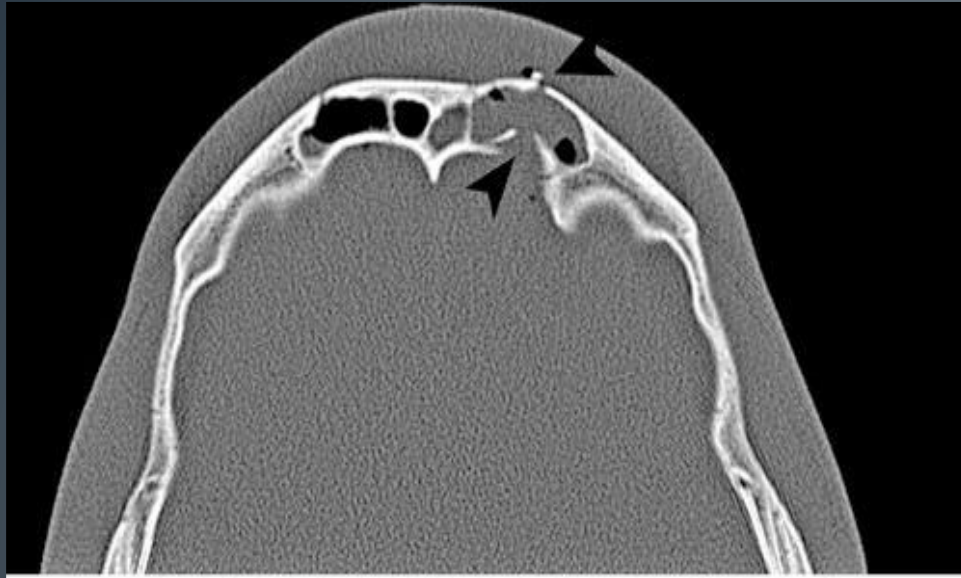


The anterior table: forehead and the superior orbital rims.
The posterior table: anterior wall of the anterior cranial fossa

Later complications of the frontal sinus: mucocoele, frontal sinusitis, osteomyelitis with anaerobes or intracranial extension leading to brain abscess



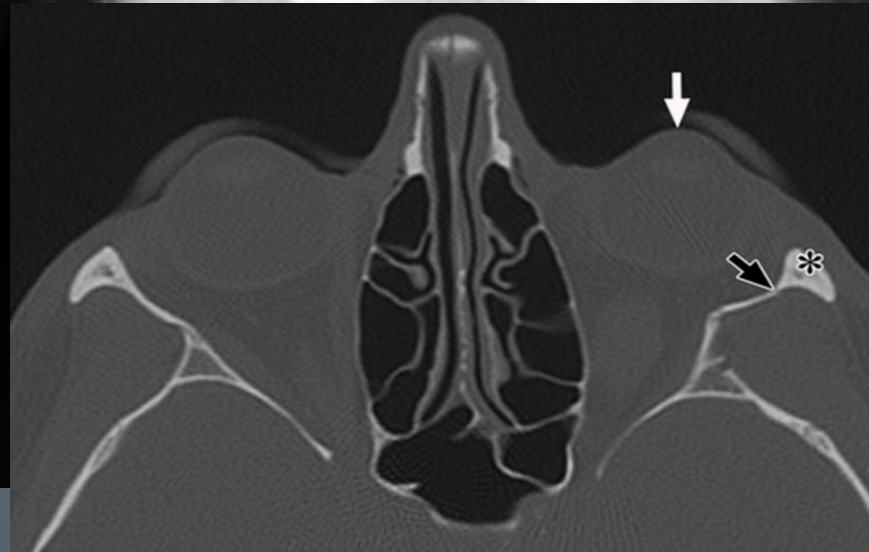
Fractures of the posterior table are rarely isolated and may result in dural tear and CSF rhinorrhea



Zygomaticomaxillary Complex Fractures

CALLED :

MALAR, TRIPOD, TETRAPOD AND ZYGOMATIC COMPLEX FRACTURE



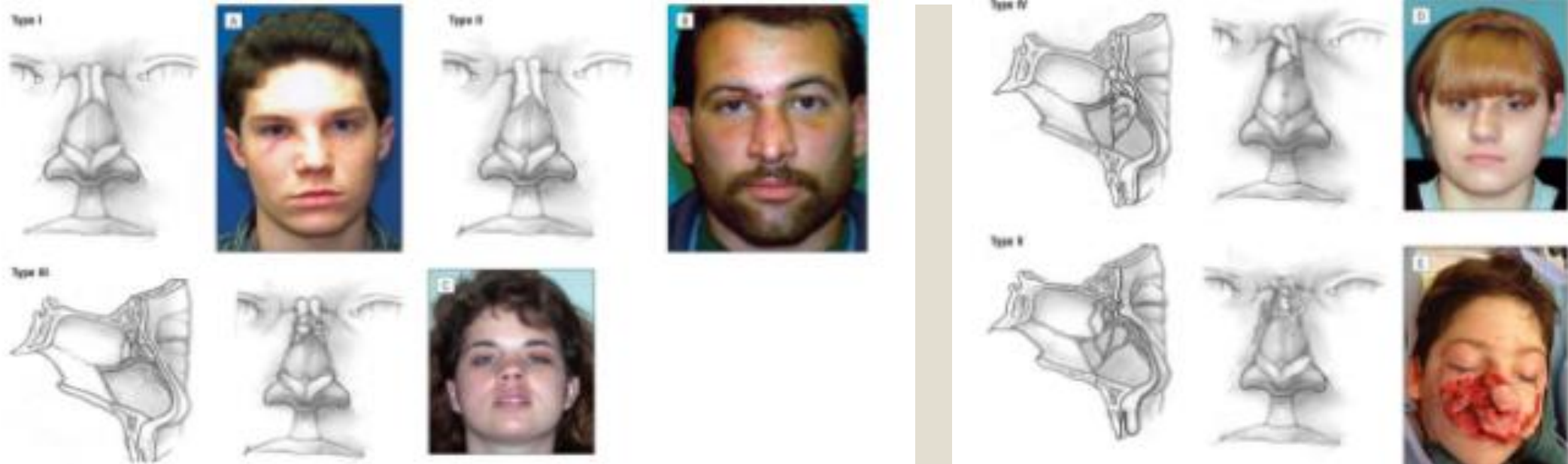
Zygomatic arch fracture. (a, b) Axial CT and surface-rendered image demonstrates a depressed, segmental fracture of the zygomatic bone (*curved arrows*)



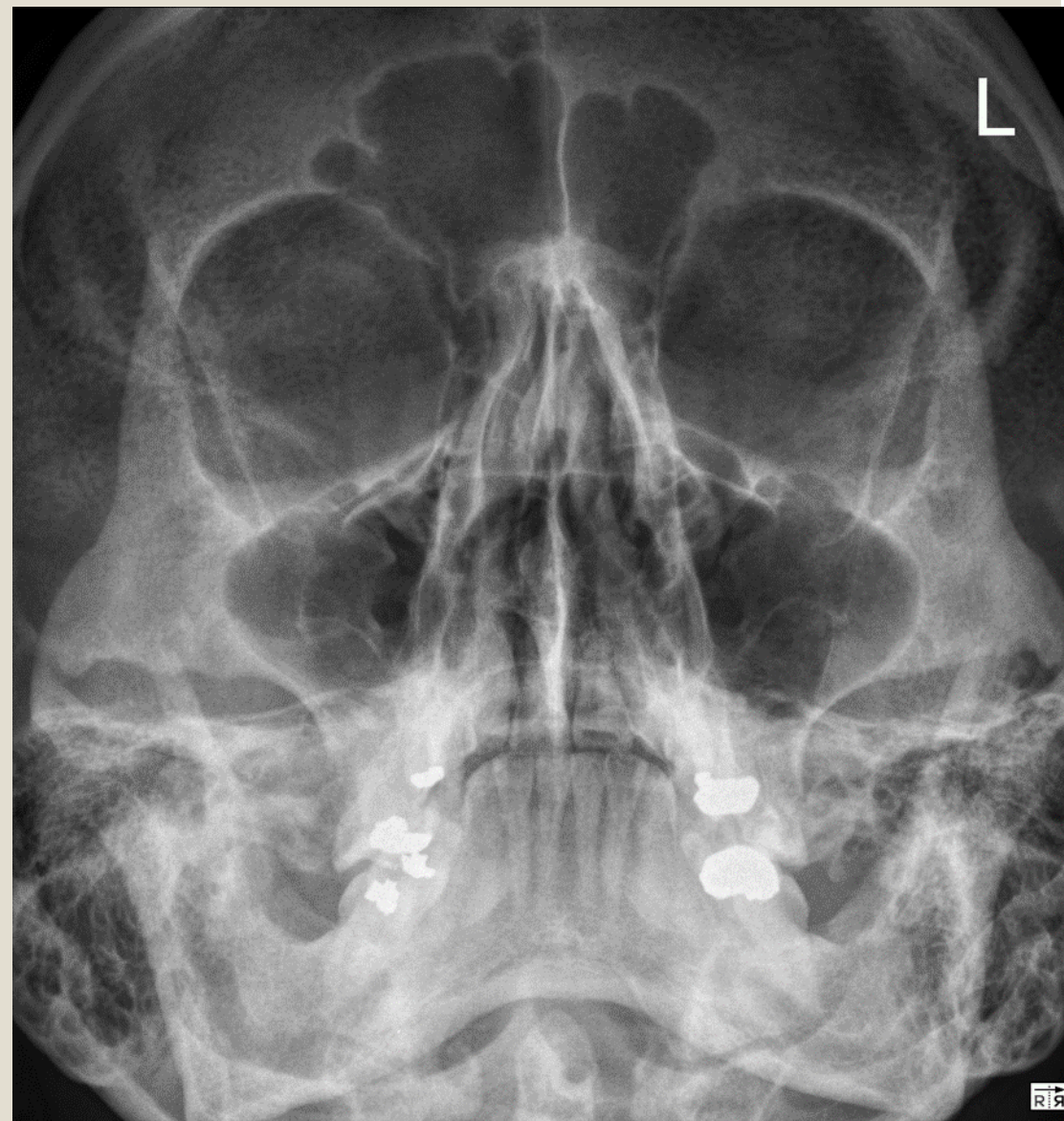
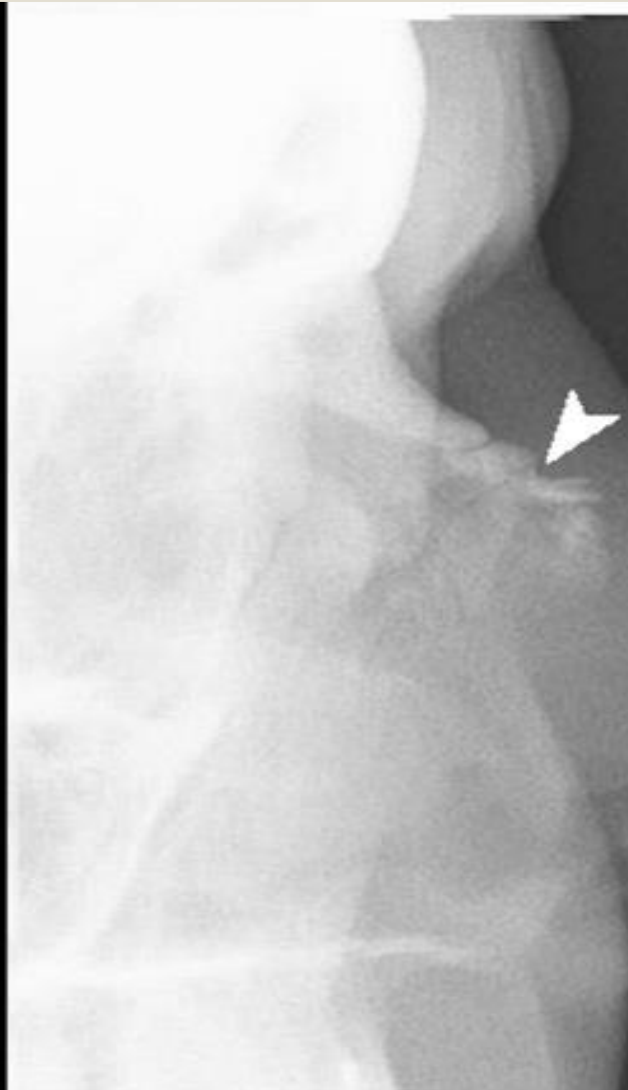
Displaced and angulated ZMC fracture.

Nasal Fracture

- The most common
- Due to facial deformity.
- Isolated nasal bone fractures to more complex patterns involving multiple bones.
- CT is important to evaluate for the presence of a septal hematoma, which may lead to complications of ischemic necrosis or abscess formation and saddle-nose deformity
- Bone fragment in the maxillary sinus may cause sinusitis.



Type I	Soft tissue injury
Type IIa	Nasal Fracture nondisplaced simple unilateral
Type IIb	Nasal Fracture nondisplaced simple bilateral
Type III	Nasal Fracture displaced simple
Type IV	Closed Comminuted Fracture nondisplaced
Type V	Open Compound fracture, fracture with airway obstruction, septal hematoma, Rhinorrhea/Liquor, Crush Injury, NOE Fracture





Nasoorbital Ethmoid Fracture (NOE)



A high-impact force to the central face may disrupt the medial maxillary and upper transverse maxillary buttresses

Depressed and displaced fractures may result in flattening of the nasal bridge and telecanthus.



Important: medial maxillary buttress at the level of the lacrimal fossa, the site of medial canthal lig attachment

Reconstruction of the attachment of the medial canthal ligament is essential to avoid telecanthus, enophthalmos, and dysfunction of the lacrimal system.

MANSON CLASSIFICATION OF NOE FRACTURES

Type I NOE

- Single-segment central fragment

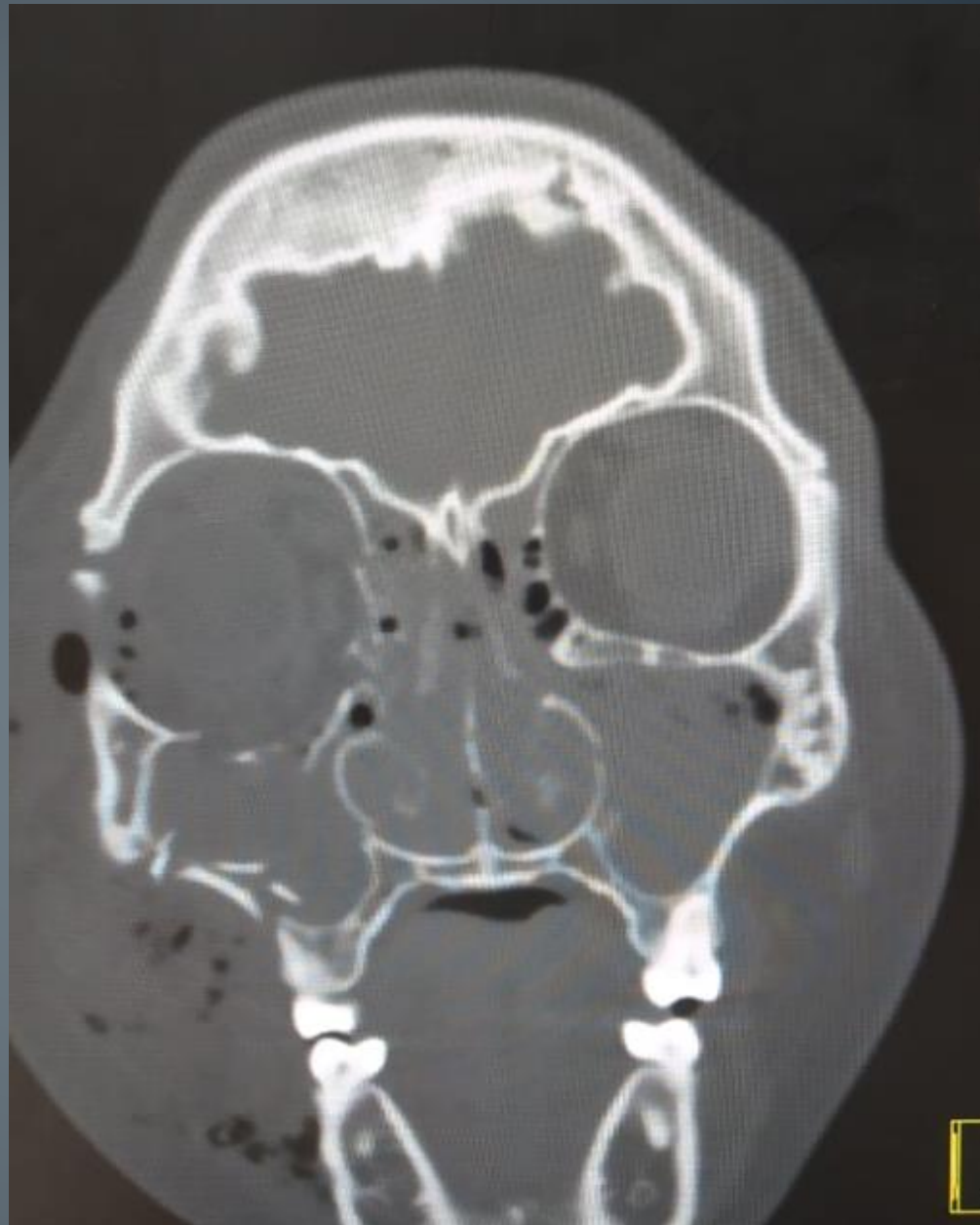
Type II NOE

- Fracture consists of comminuted central fragments external to the medial canthal tendon insertion

Type III NOE

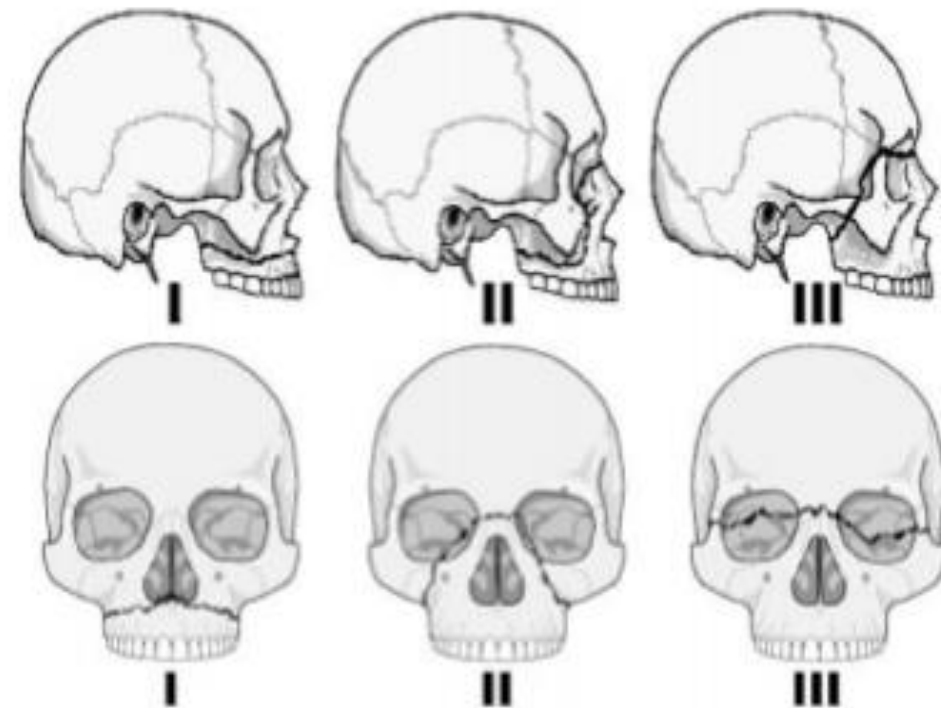
- The fracture line extends into the medial canthal tendon insertion segment



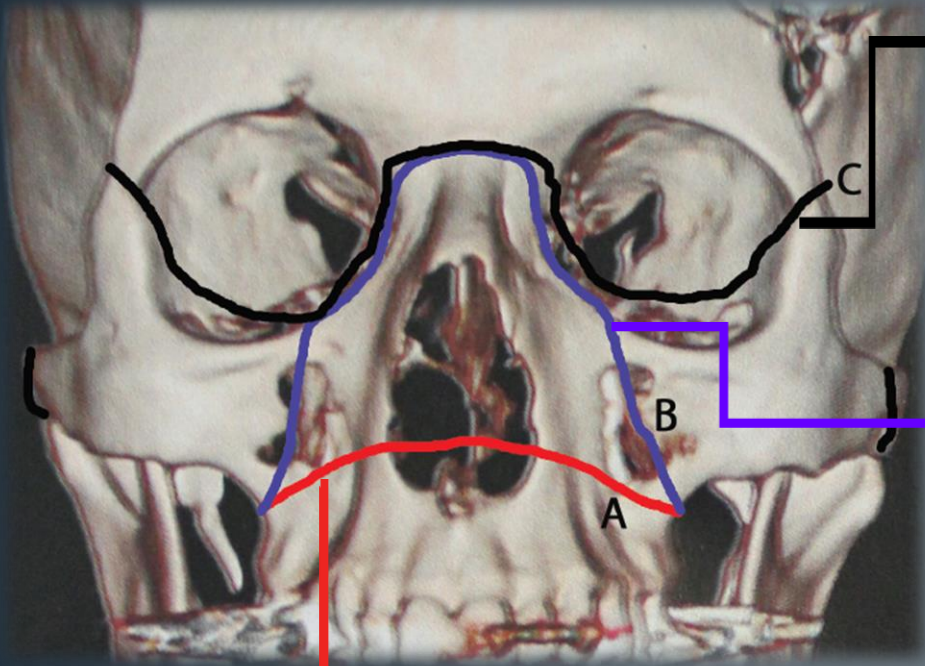


Naso-orbital-ethmoid (NOE) fracture

Maxillary Fractures



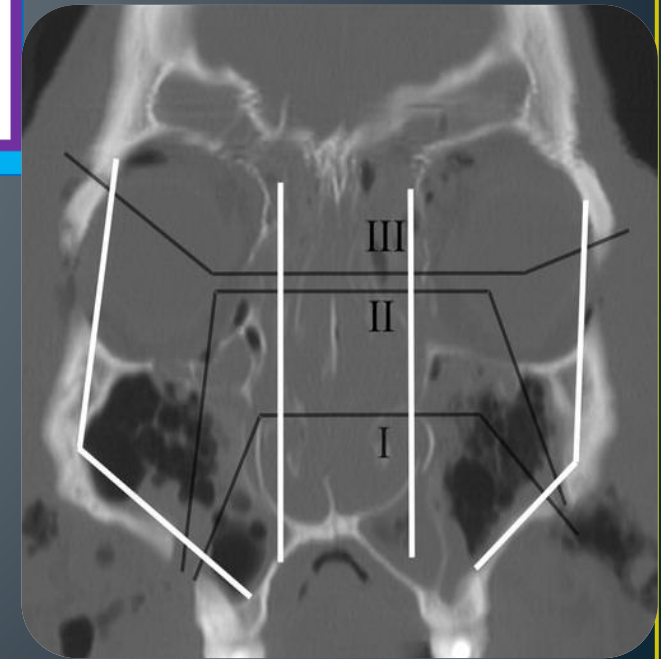
Le Fort Fracture



Le Fort III / craniofacial dissociation : the separation of the whole mid-face from the skull

Le Fort II / the pyramidal fracture : the separation of nasomaxillary complex

Le Fort I : separation of maxilla from the mid-face



	Tipe I	Tipe II	Tipe III
Trauma level	Superior to the alveolar process of the Maxilla.	Nasal bones with disruption of the lateral and medial maxillary buttresses.	Orbital level.
Disruption	Medial and lateral Maxillary Buttresses.	Inferior lateral and superior medial maxillary Buttresses	Superior medial, lateral, and upper transverse maxillary Buttresses.
Results	Free-floating Palate.	Step deformities at the nasal bridge and infraorbital rim Possibly “dish-face” deformity	Craniofacial instability Possibly “dish-face” deformity

Sign and symptoms LeFort



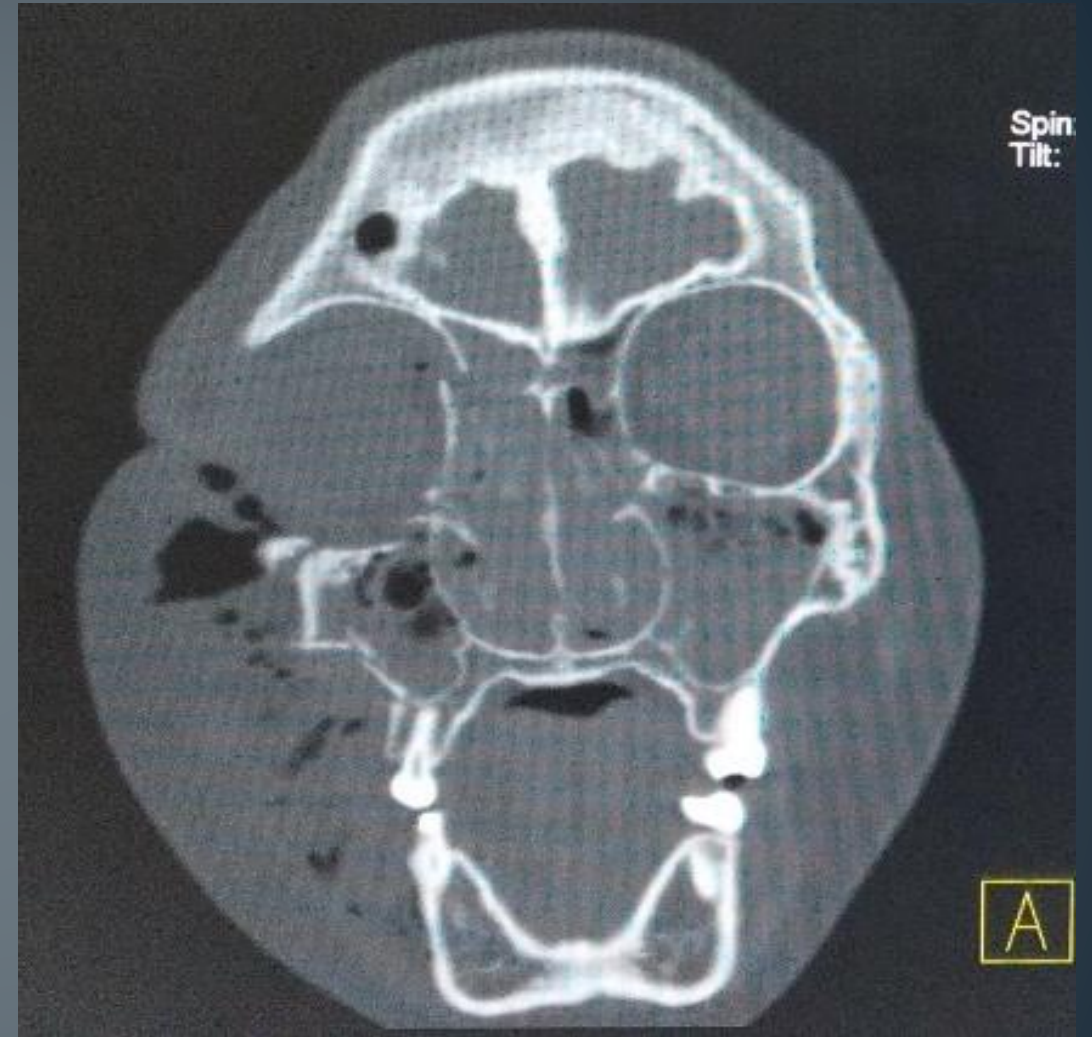
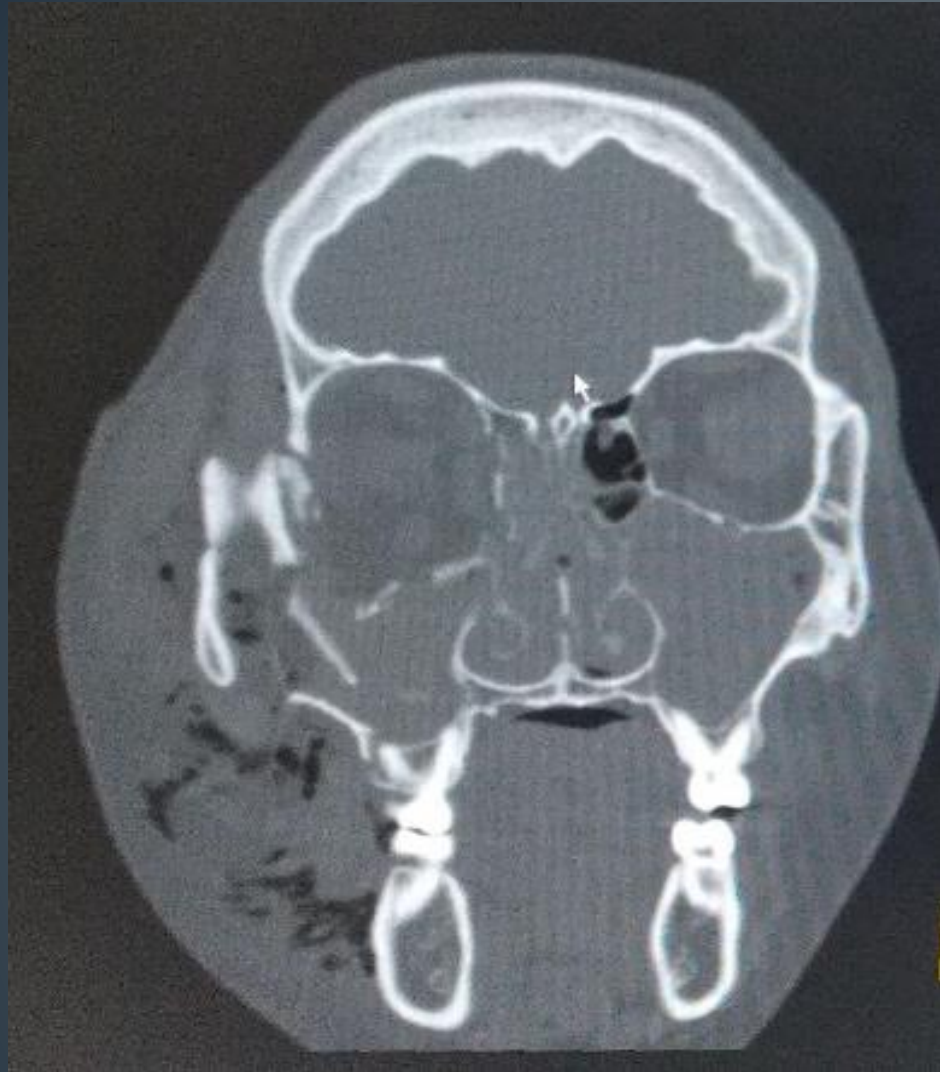
- Mobility of the maxilla
- Open bite deformity.
- Malocclusion
- Epistaxis
- Hypoesthesia
- Bilateral periorbital ecchymosis / racoon's eyes



Le Fort I fracture.



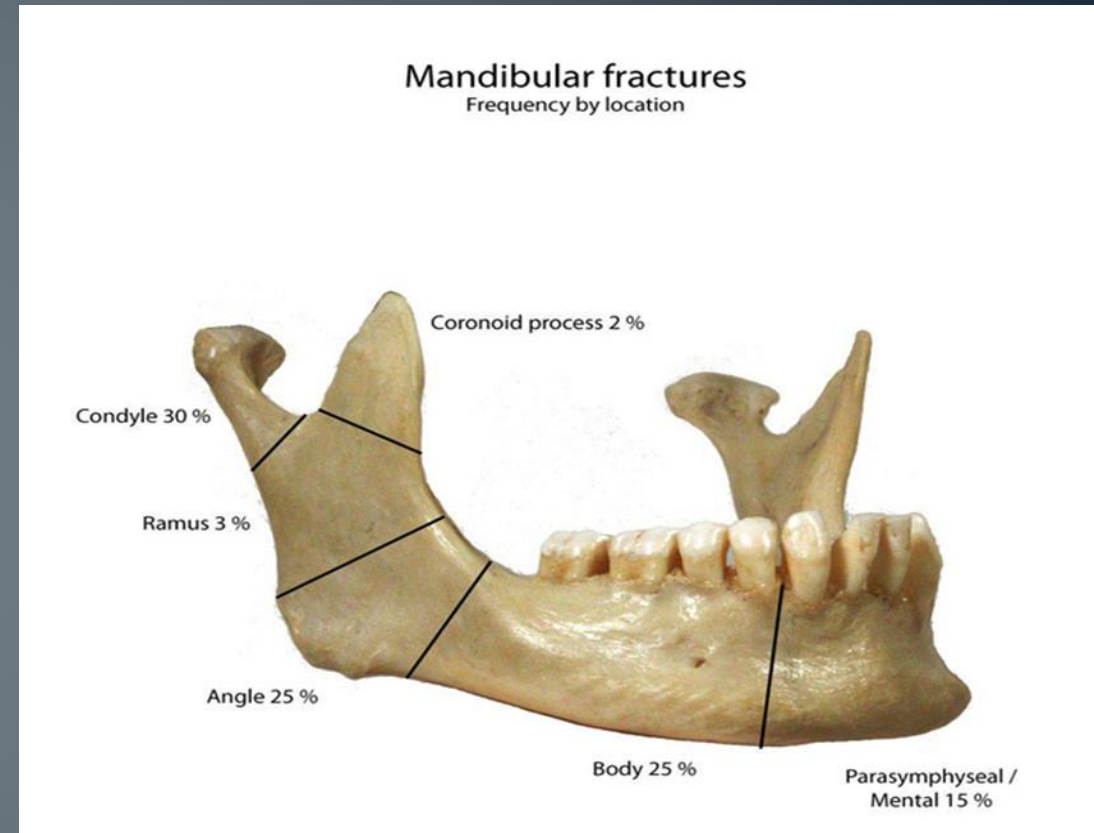
Le Fort II fracture

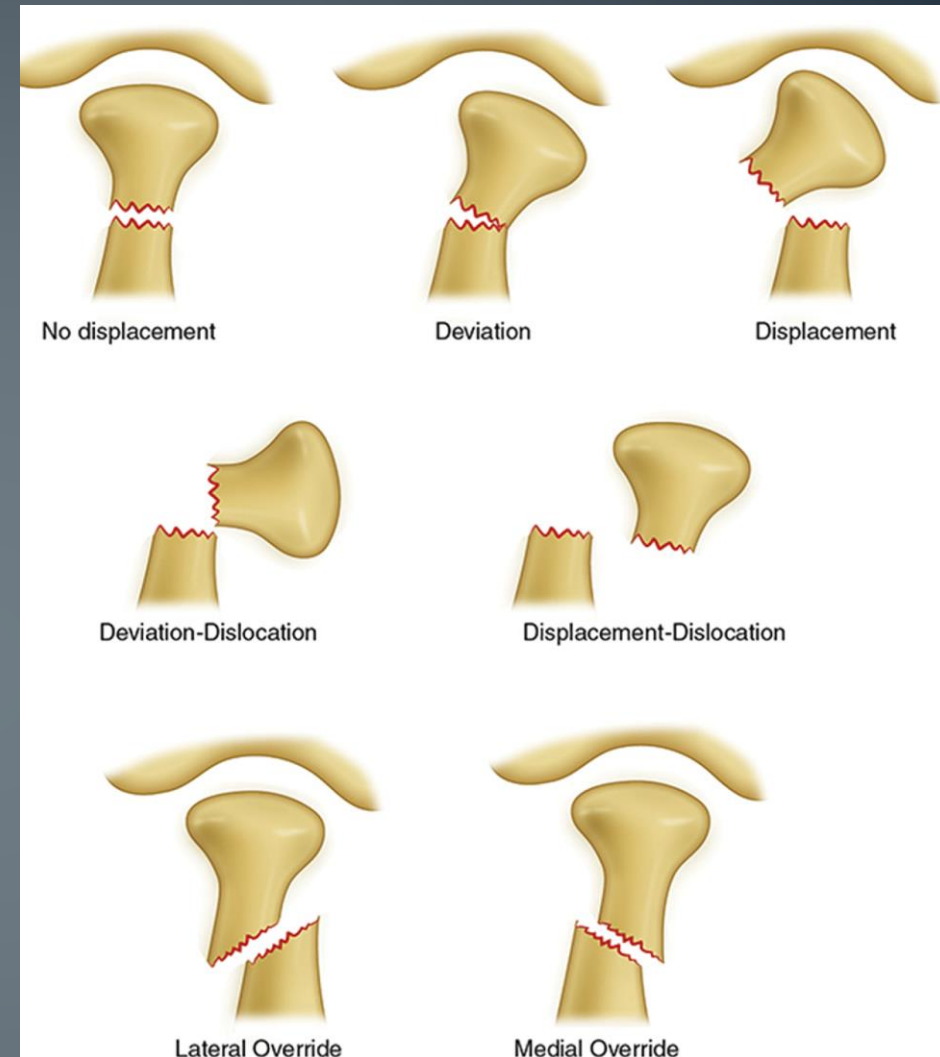
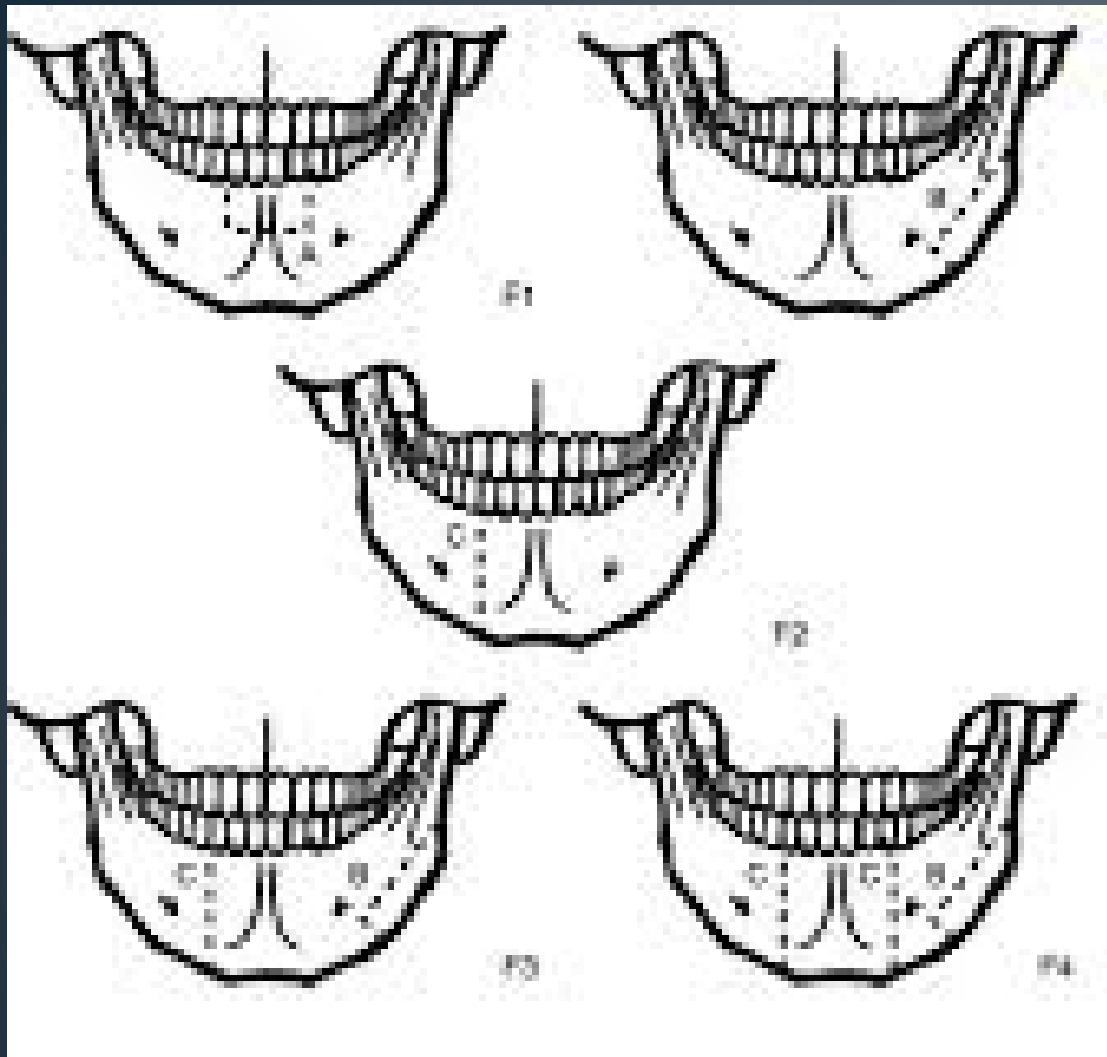


- **LeFort III fracture.**

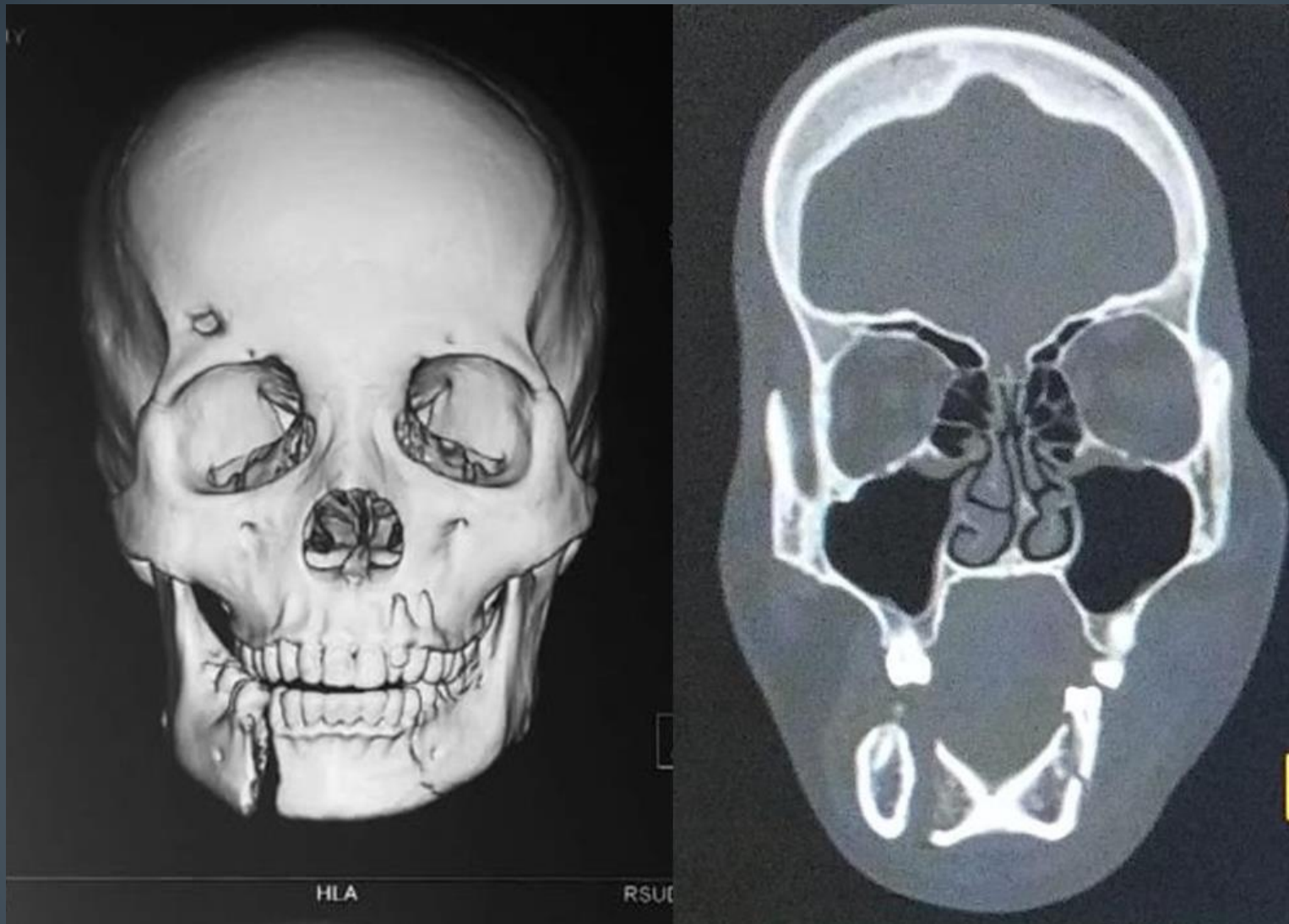
Mandibula Fractures

- The mandible fractures: symphyseal, parasymphyseal, alveolar, body, angle, ramus, condylar process, and coronoid processes. Condylar process fractures are common, particularly the neck.
- The condylar head is often displaced medially in patients with condylar neck fractures due to the unopposed action of the lateral pterygoid muscle.
- CT angiogram of neck is indicated in fracture dislocation of condyle to assess for vascular injuries such as dissection.



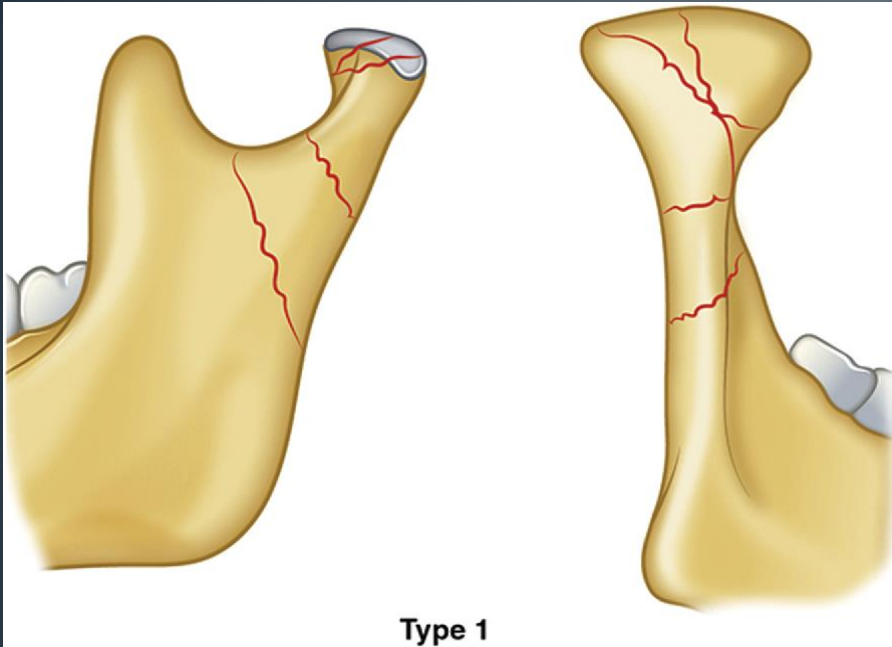


Common definitions to describe the position of condylar head in relation to mandibular condylar fractures.

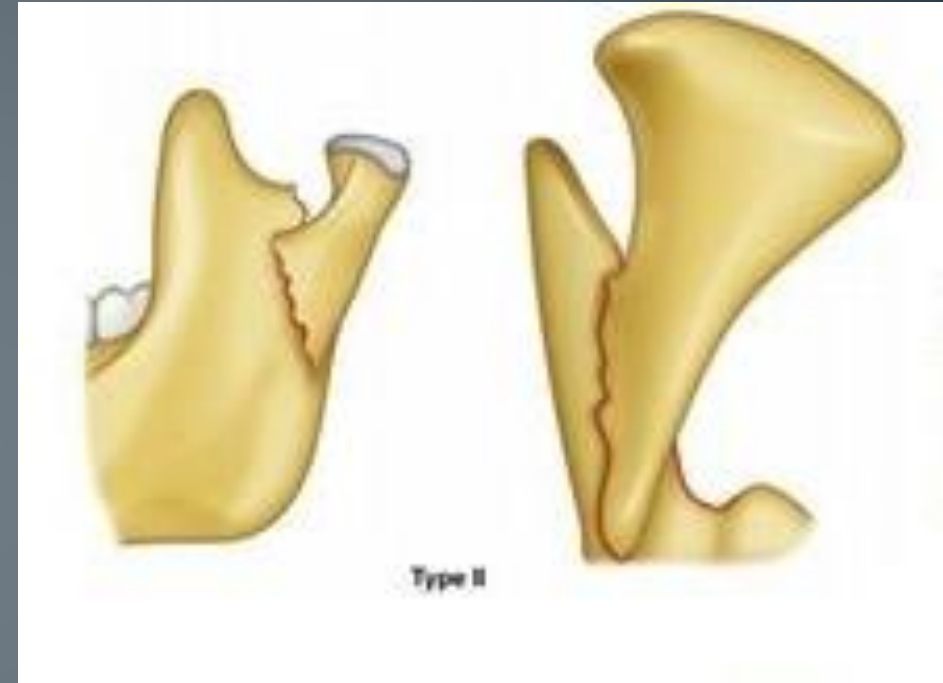


Mandible fractures, surface-rendered image and coronal CT reformation show bilateral fracture of body of mandible

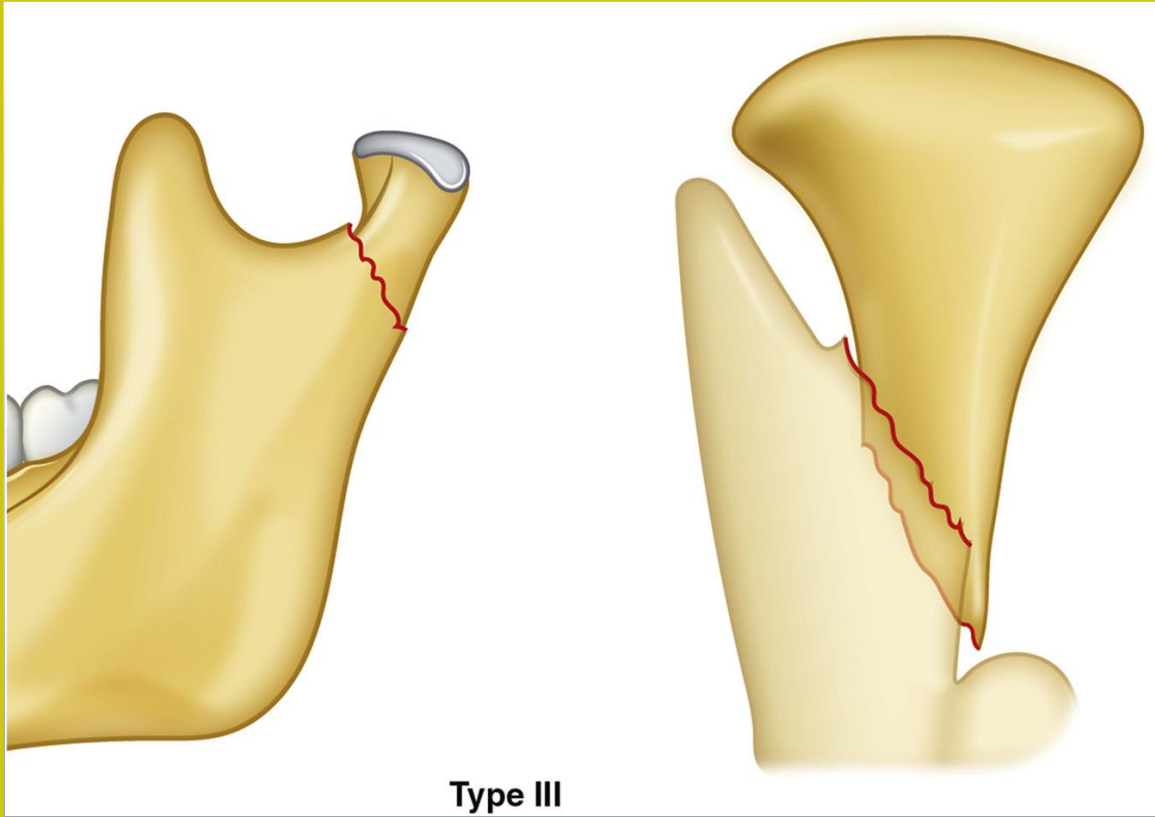
Spießl and Schroll Classification of The Condylar Mandibular Fracture



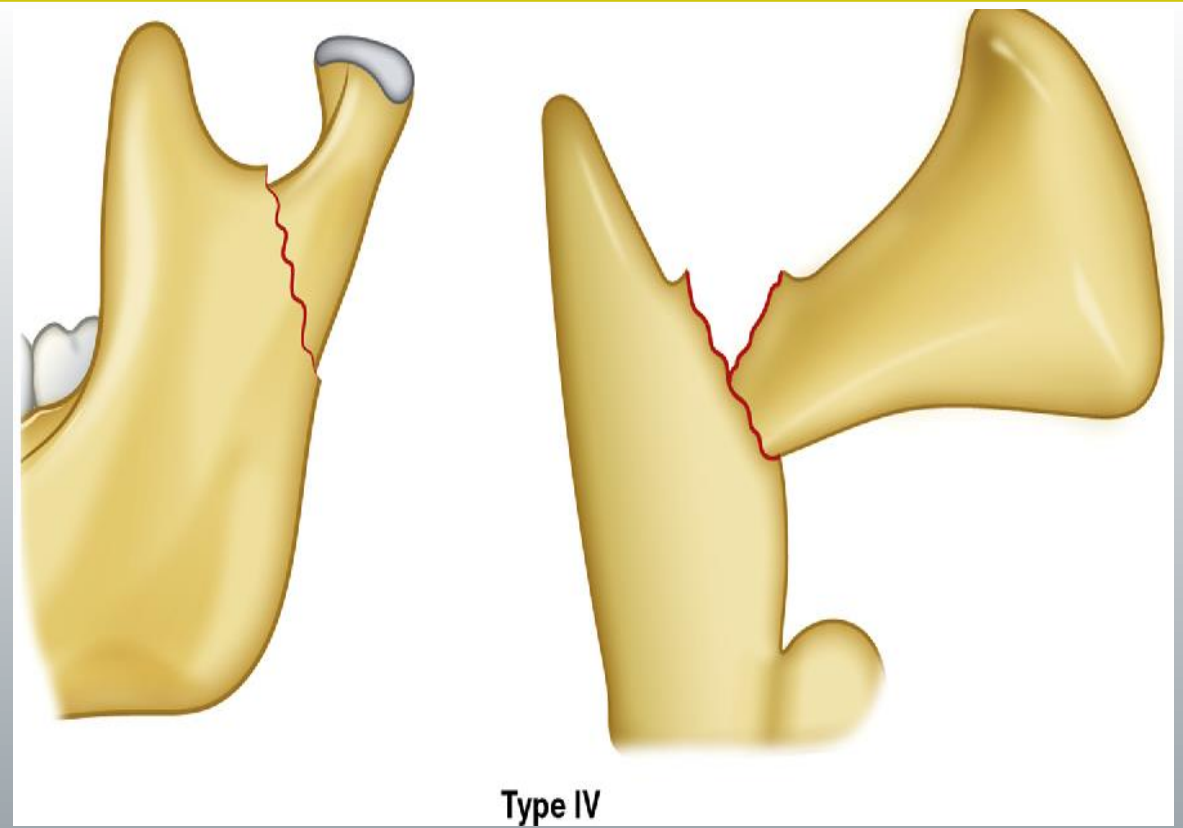
Type 1
“collum fractures” without considerable displacement.



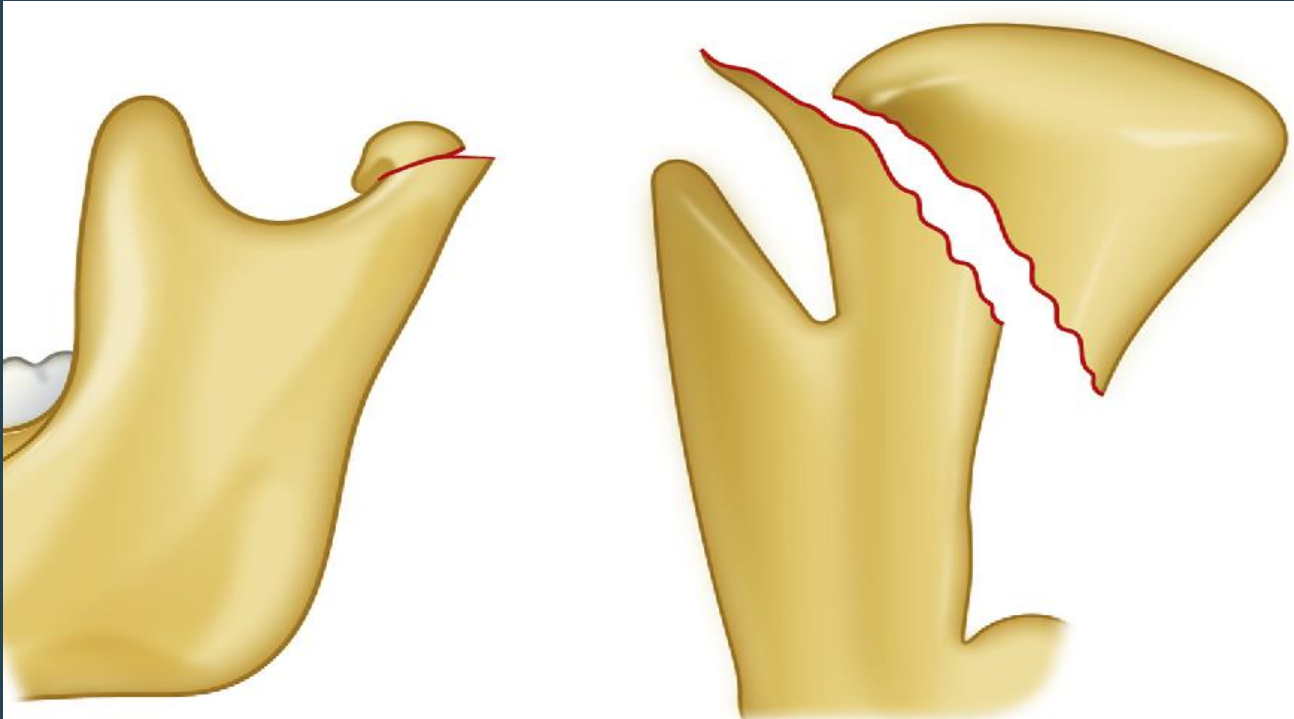
Type II
Low condylar neck fractures with displacement.



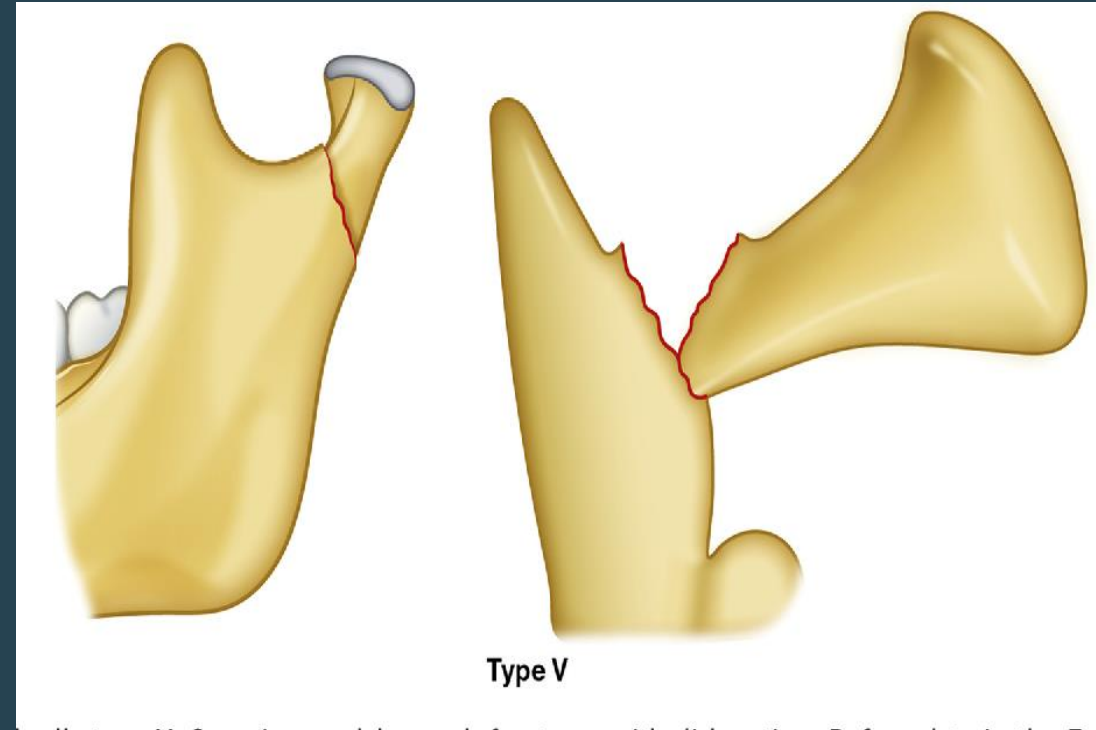
Type III
Superior condylar neck fractures with displacement (High collum)



Type IV.
Low condylar neck fractures with dislocation (Deep Collum)

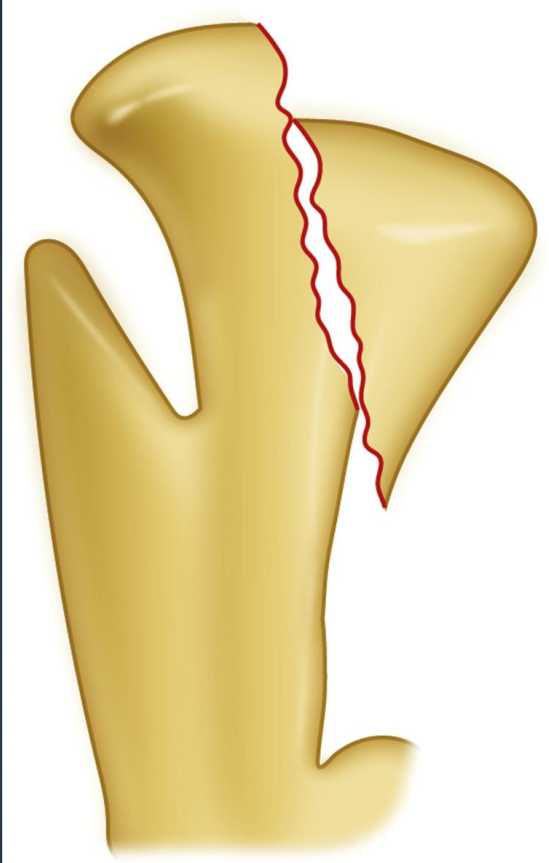


Type V
Superior condylar neck fractures with dislocation (High Collum with dislocation)



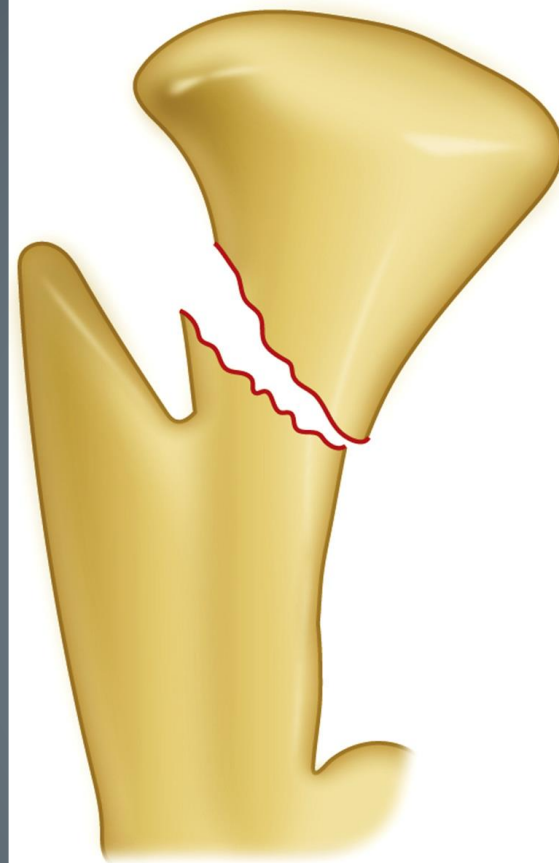
Type VI
Intracapsular fractures. Diacapitular fractures.

Diacapitular Fractures



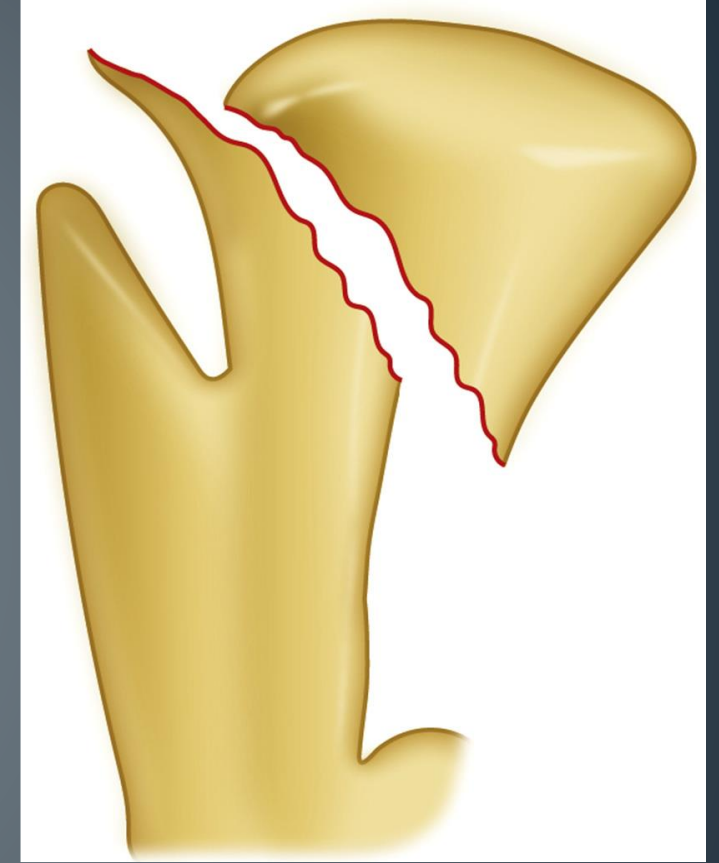
Type A

Continuous bony contact within the articular fossa. No loss of ramus height.



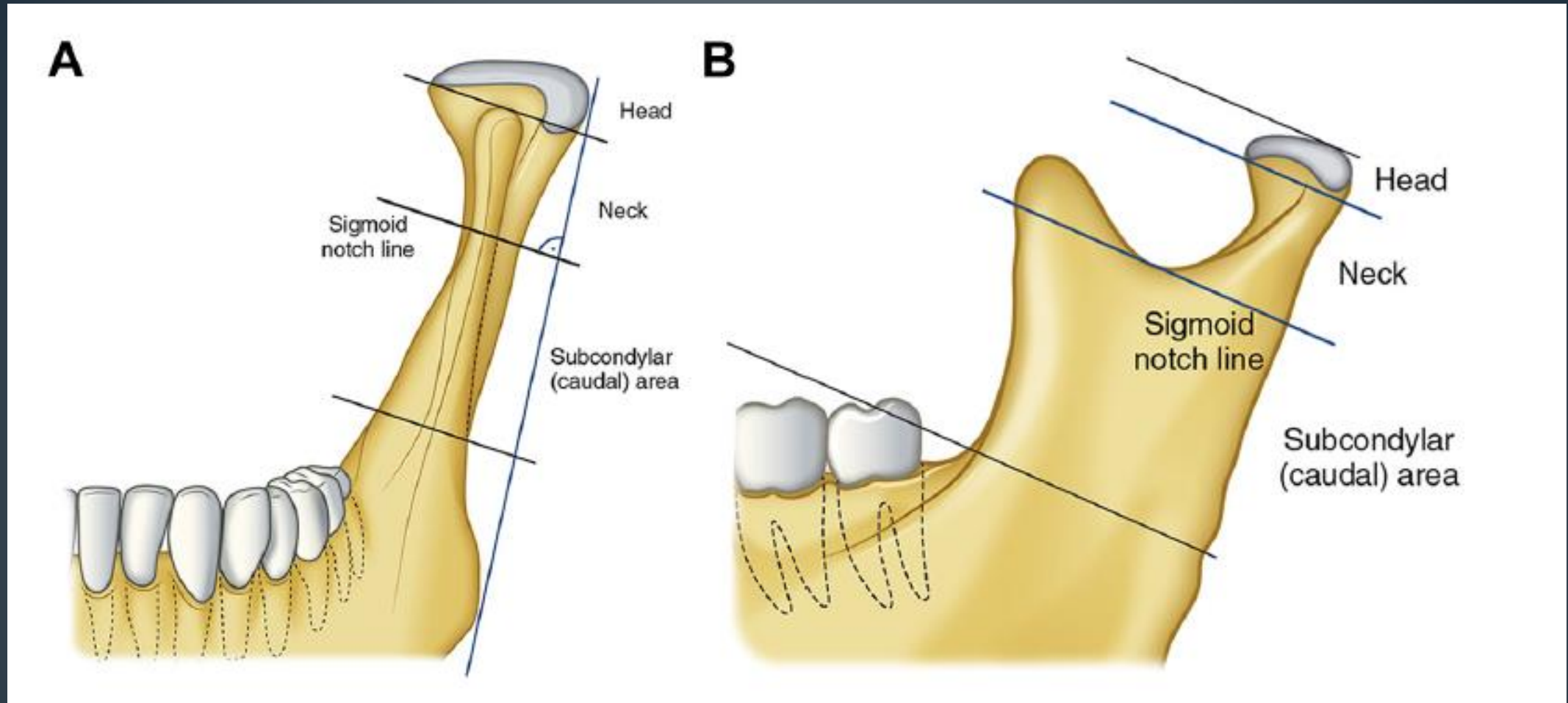
Type B

Loss of support within the articular fossa and loss of height of the mandibular ramus.

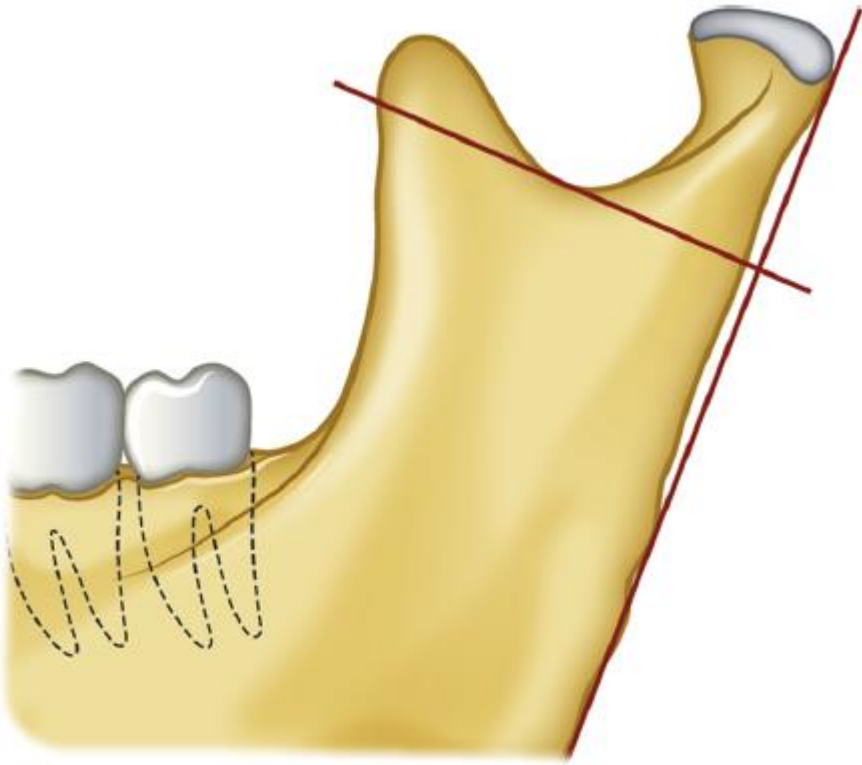


Type C

The most superior portion of the fracture is below the level of the lateral ligament. Loss of ramus height is appreciated due to involvement of the entirety of the condylar head.

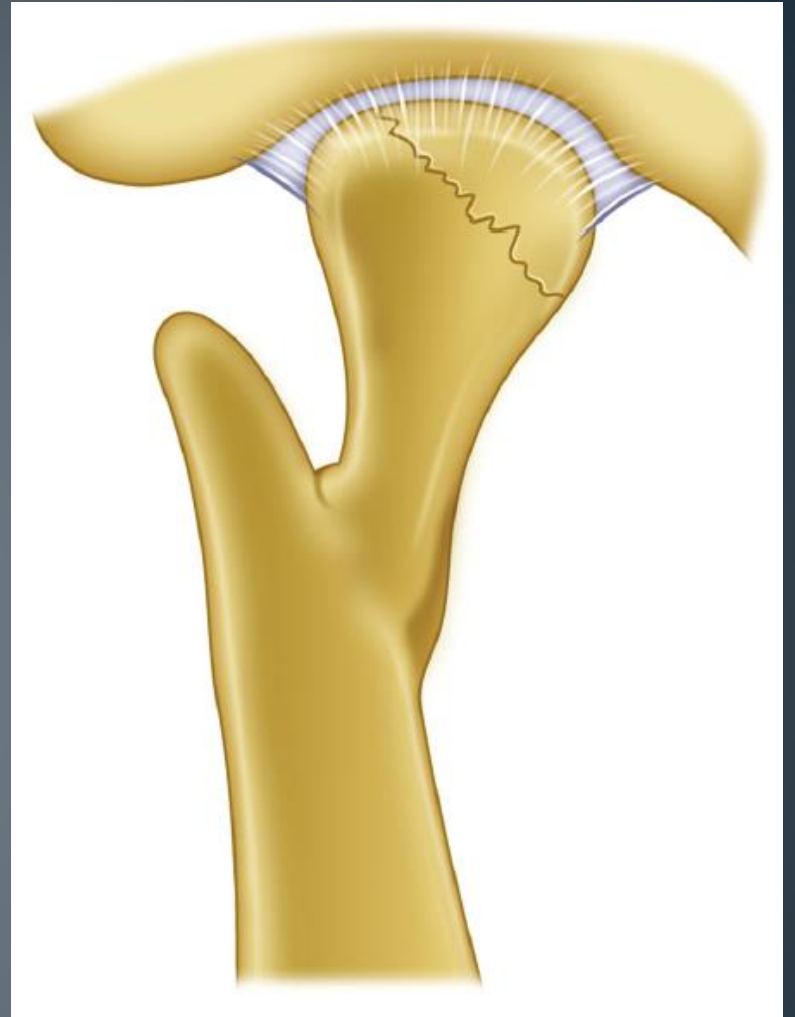


SIMPLIFIED CLASSIFICATION SYSTEM AS DESCRIBED BY ELLIS

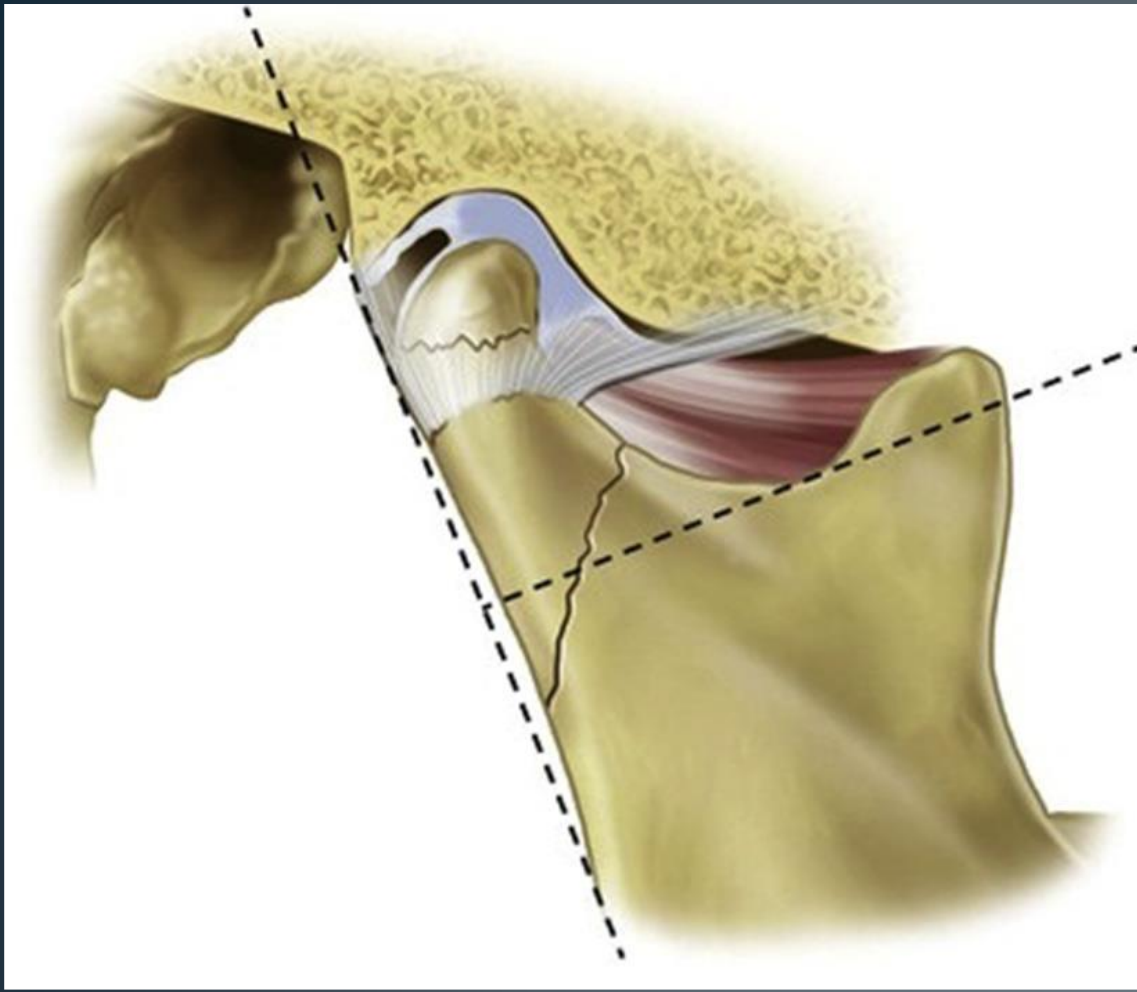


Strausbourg Osteosynthesis Research Group classification.

Landmark in is Line A, a perpendicular line through the sigmoid notch to the tangent of the ramus.

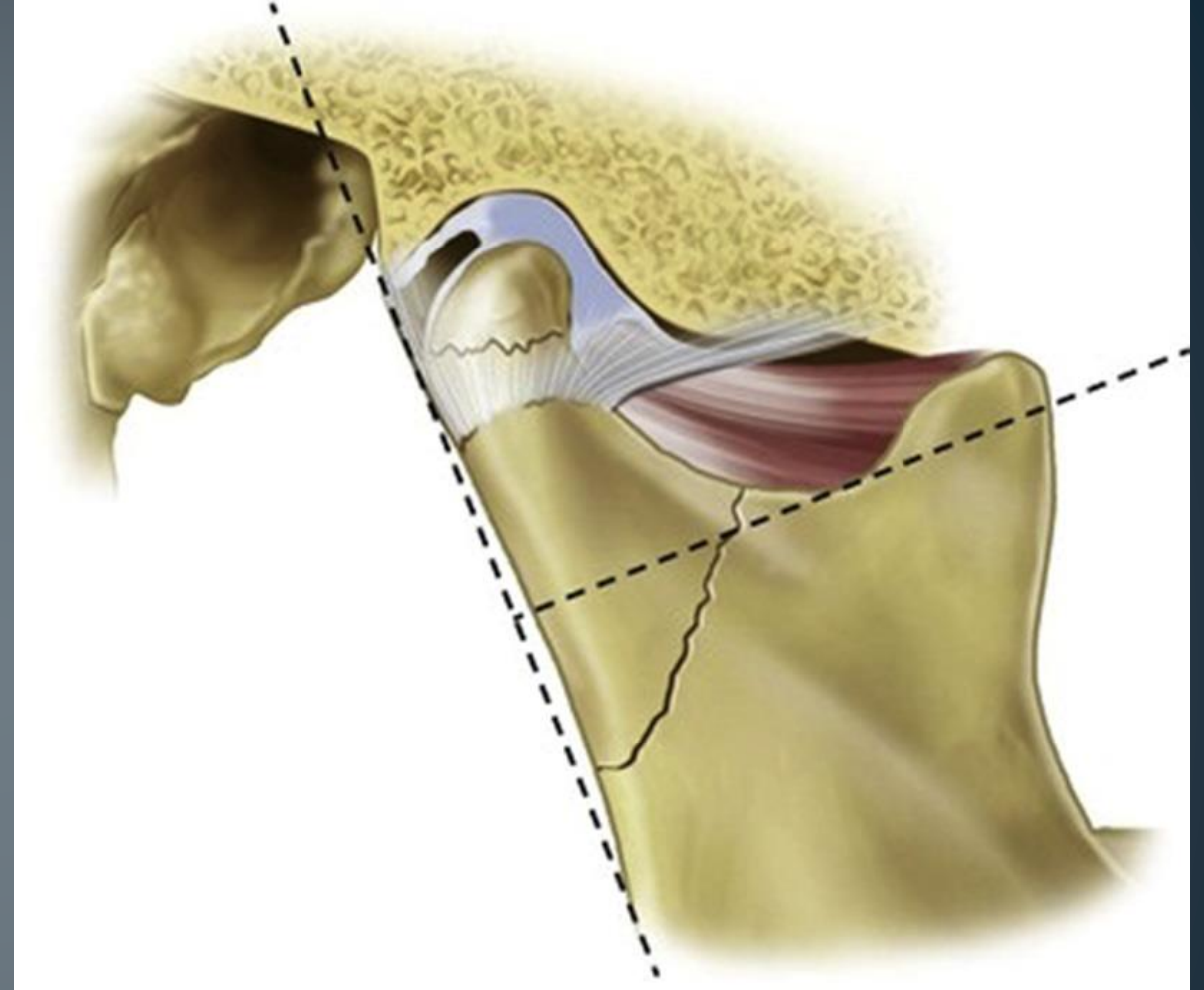


Diacapitular fracture extending outside the temporomandibular joint capsule without displacement of the articulating surface of the condylar head.



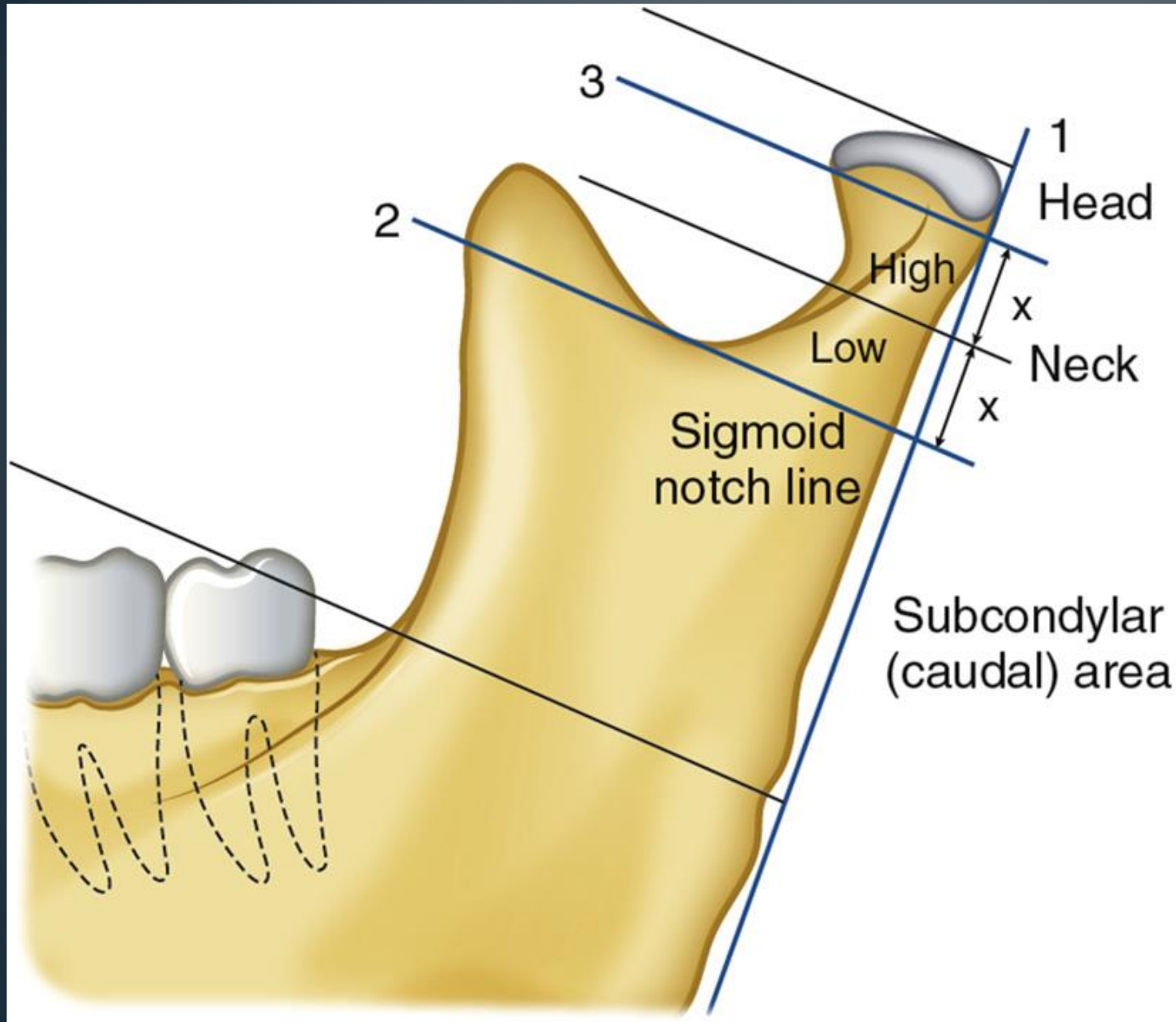
Condylar neck fracture

The fracture line starts above Line A, and more than half of the fracture is above Line A in the lateral view.

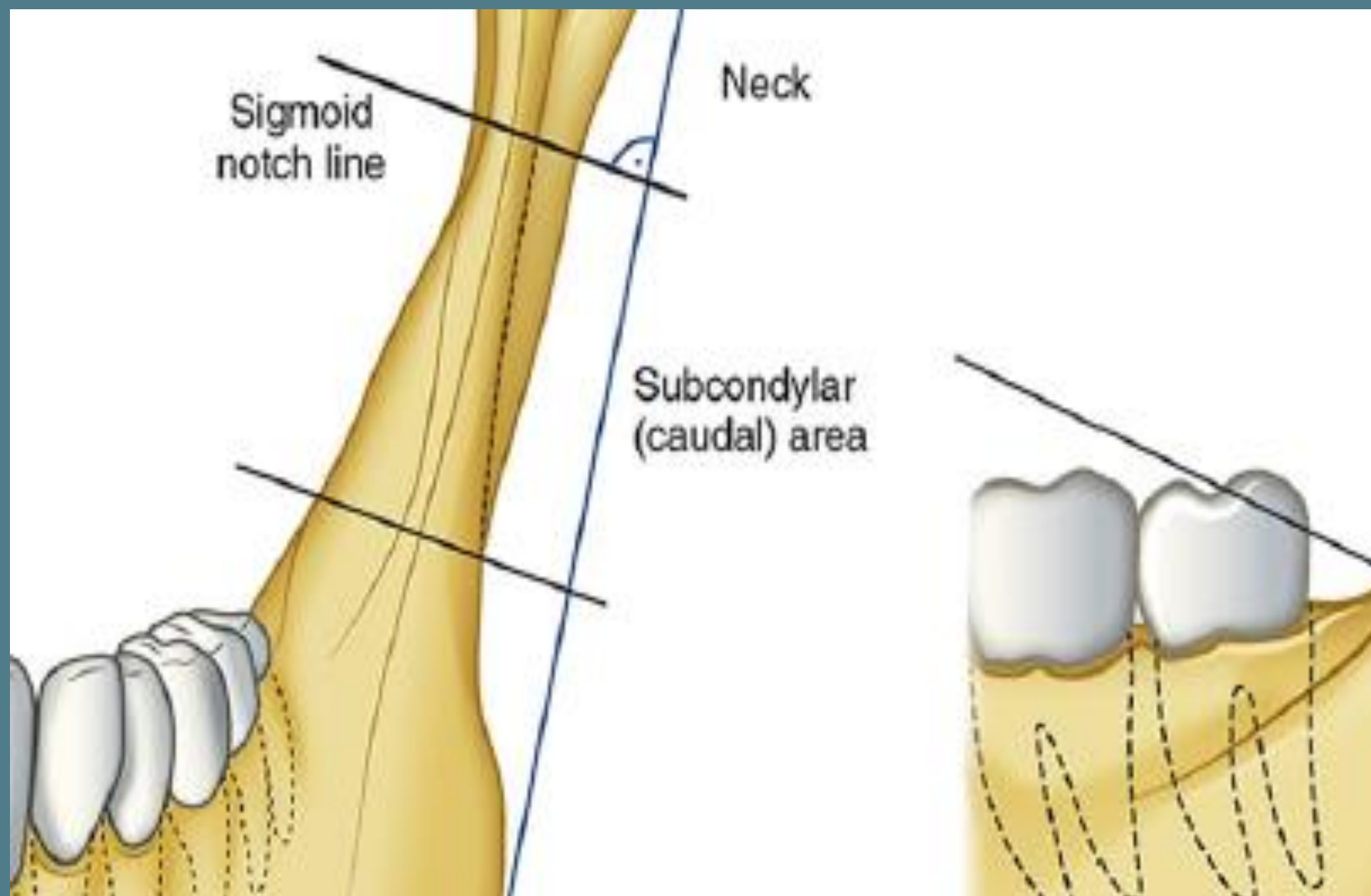


Condylar base (sub condylar) fracture

The fracture line runs posterior to the mandibular foramen, and more than half the length of the fracture extends below Line A.



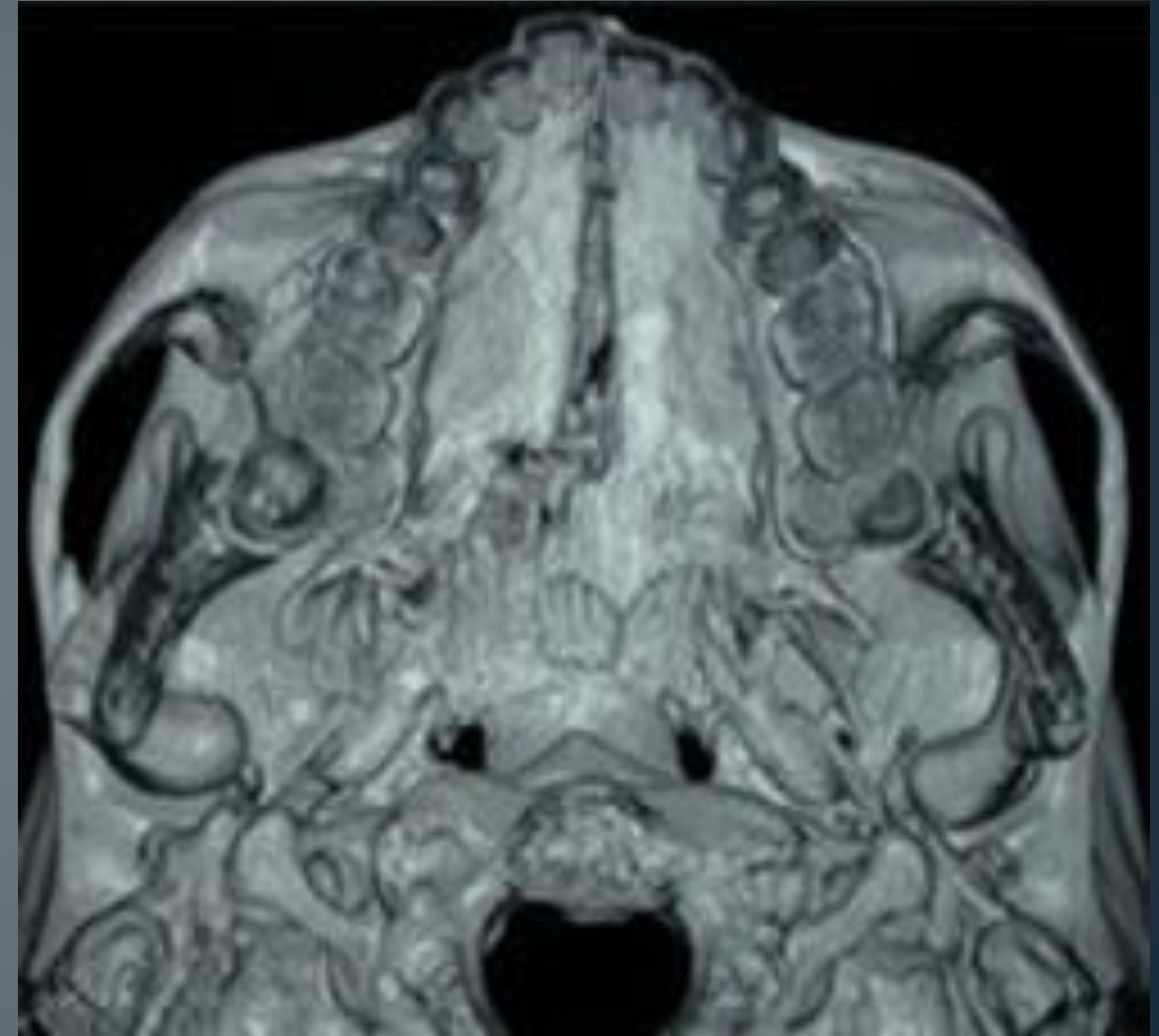
AO Foundation
classification of “high-
neck” and “low-neck”
mandibular condylar
fractures.



PALATAL FRACTURE

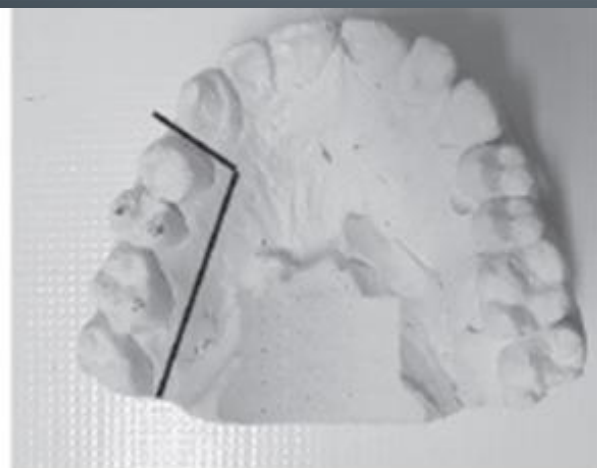
Sign and Symptom:

- Mobility of alveolar segments
- Malocclusion
- Ecchymosis of the palate





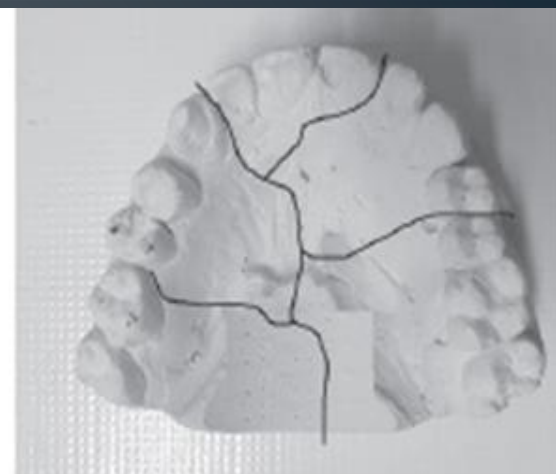
Type 1a



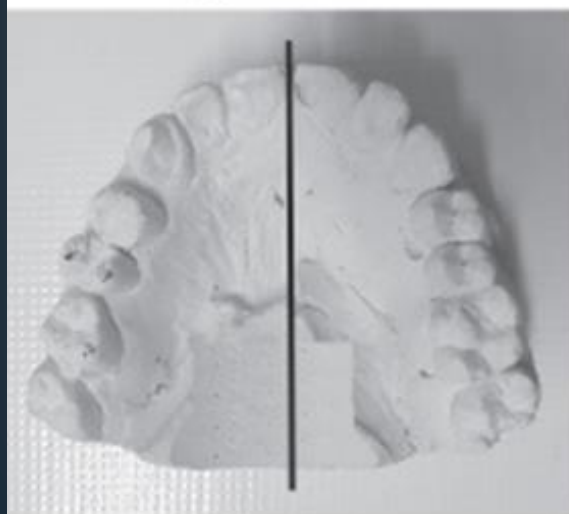
Type 1b



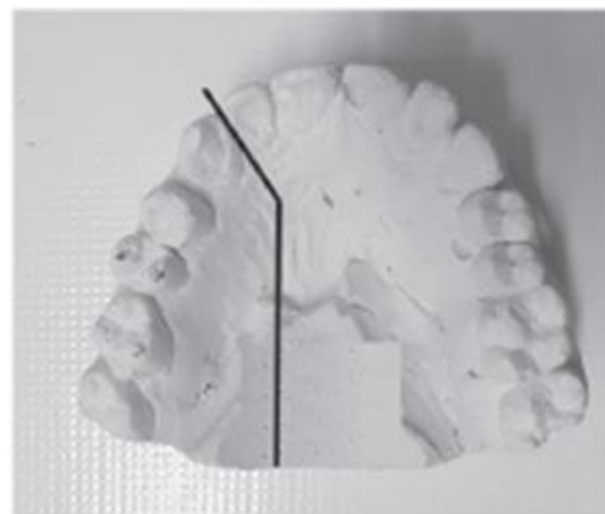
Type 4



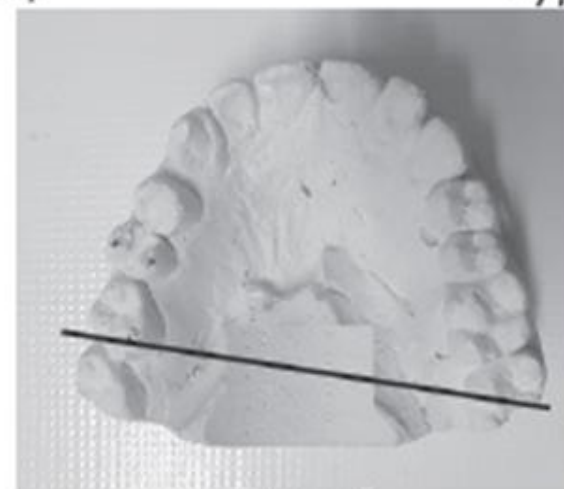
Type 5



Type 2



Type 3



Type 6

THE CHALLENGES IN IMPLEMENTING AI ON MAXILLOFACIAL FRACTURE

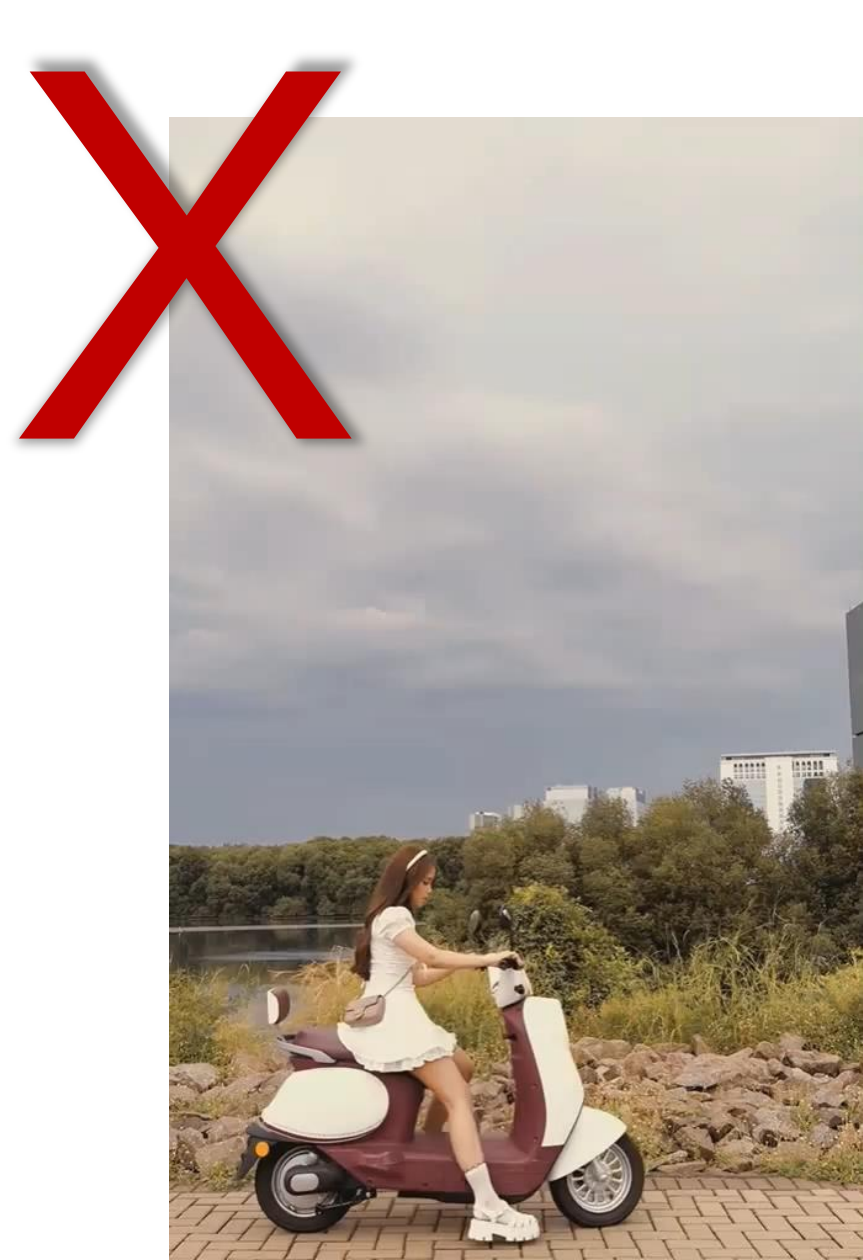
- Different AI algorithms and software platforms can give inconsistent results, especially if they are not trained on diverse data sets
- The lack of standardization in AI systems means that the accuracy of AI results can vary depending on the platform used.
- AI integration in health care settings has a large financial impact and requires significant resources and costs.
- Although AI can provide automated results, review by a clinician is still needed, especially in identifying some possible errors when identifying certain anatomical structures.

Conclusion

- Facial trauma → multidetector CT → first-choice imaging quickly and accurately.
- Clinical management and surgical planning → radiologists must communicate their findings to surgeons effectively.
- In Le Fort fractures : The pterygoid plates and the posterior maxilla, in three basic patterns, on maxillary occlusion-bearing segments.
- Naso-orbito-ethmoid depends on the extent of injury to the attachment of the medial canthal tendon, complications like nasofrontal duct disruption.

- Zygomaticomaxillary complex → Displacement and lateral orbital wall
- In orbital fractures → entrapment of the inferior rectus muscles can lead to diplopia, globe or infraorbital nerve.
- Frontal sinus fractures that extend through the posterior sinus wall can create a communication with the anterior cranial fossa resulting in leakage of cerebrospinal fluid, intracranial bleeding.
- It is essential to categorize fracture patterns and highlight features that may affect fracture management in radiology reports of facial trauma.

Simetry are usual
Asimetry is a suspect



Di kota Makasar banyak Melati
Harum mewangi menarik hati
Dokter sekalian yang saya hormati
Terima kasih menyimak presentasi kami

TERIMA KASIH