

Maxillofacial injuries

Anatomy of the Face

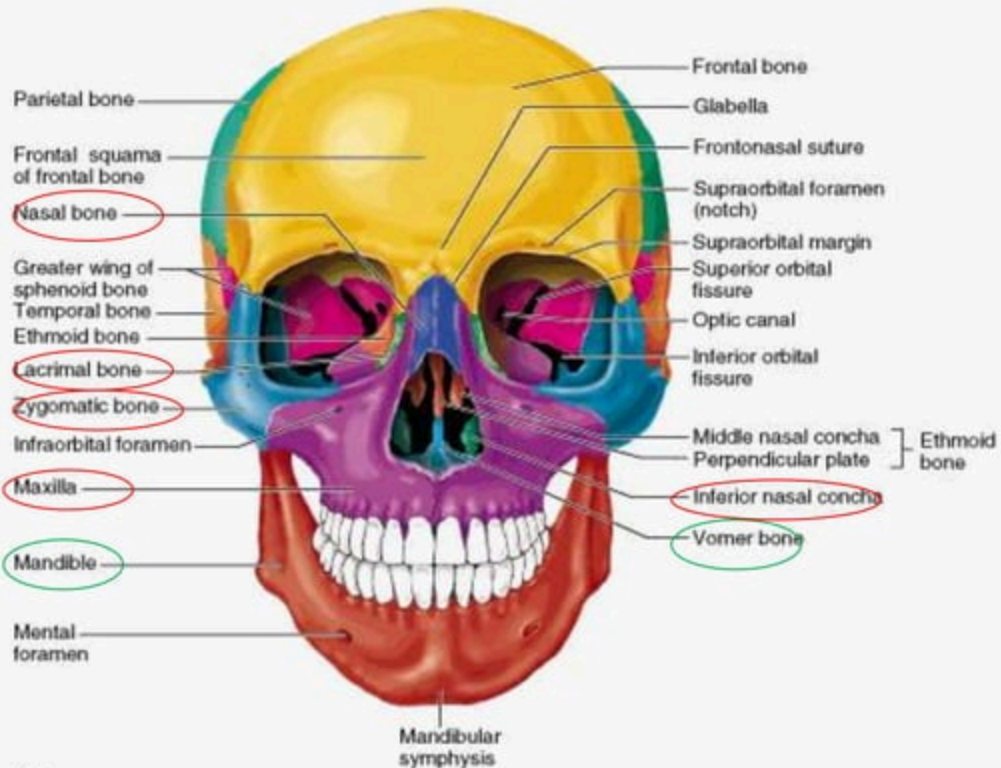
The facial bones

Single bone :

- Mandible
- Vomer

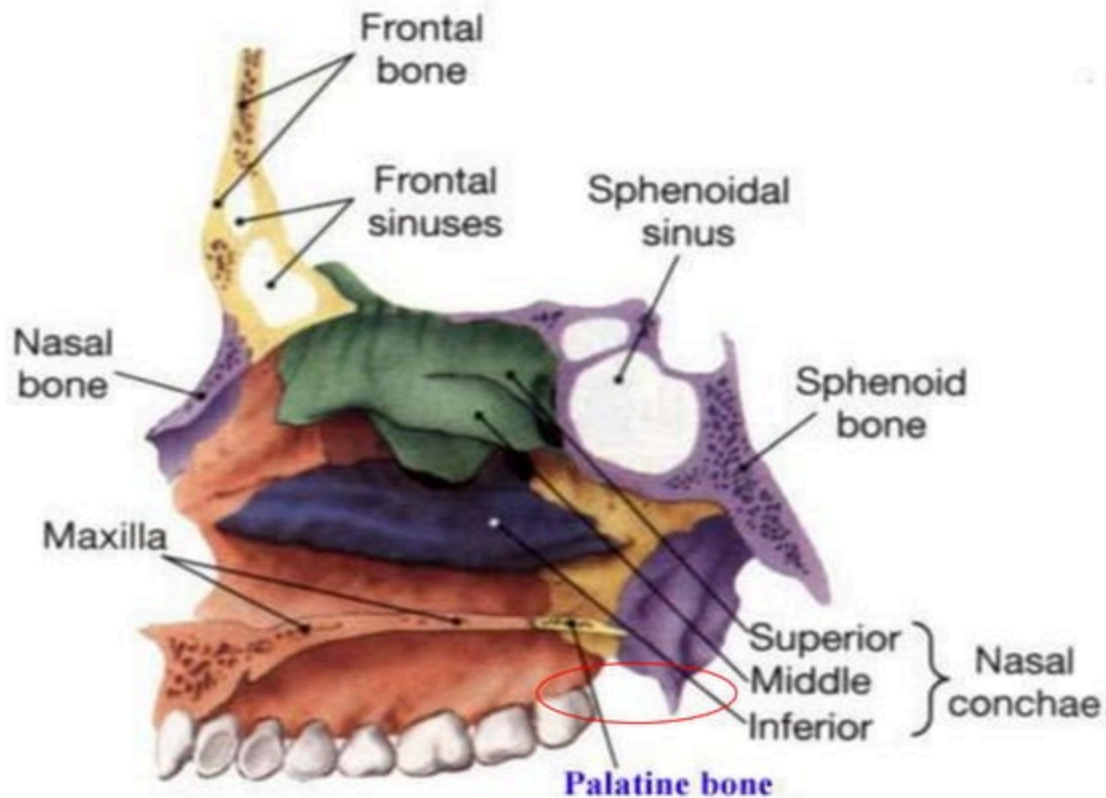
Paired bones:

- Maxilla
- Zygomatic
- Lacrimal bone
- Nasal bone
- Inferior nasal conchae
- Palatine bone



(a)

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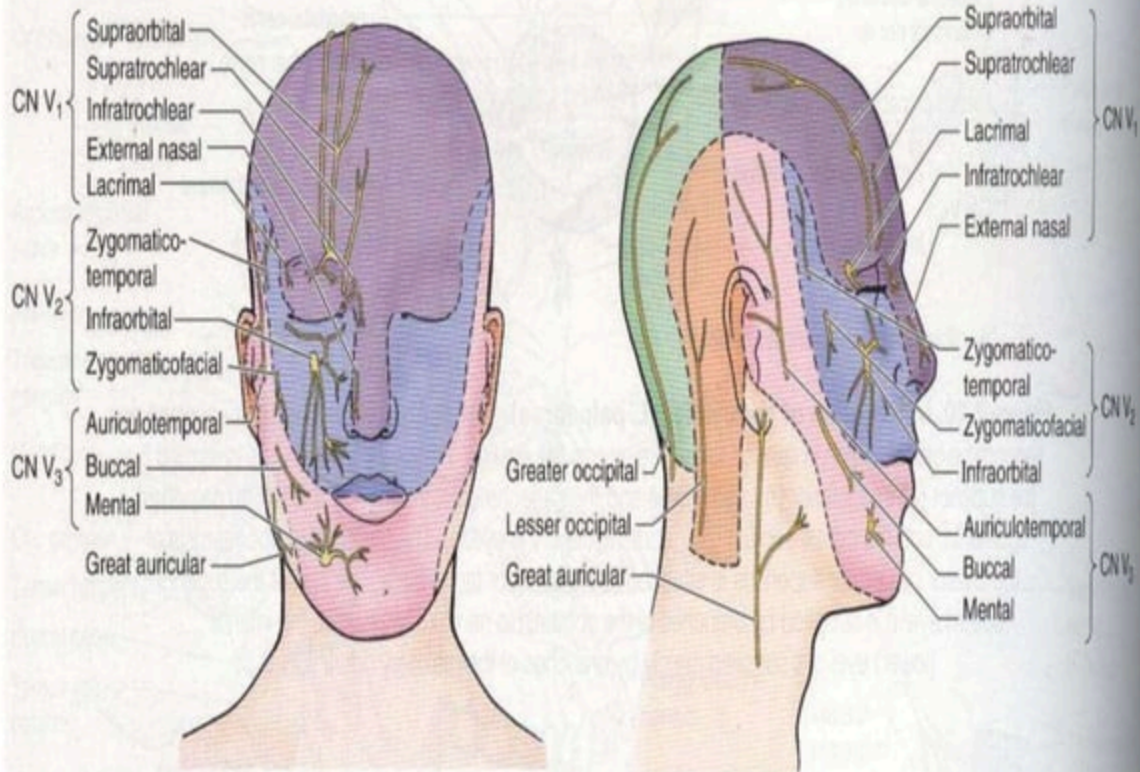


Sensory nerves of the face and scalp

Trigeminal nerve (CN V) divided into 3 :

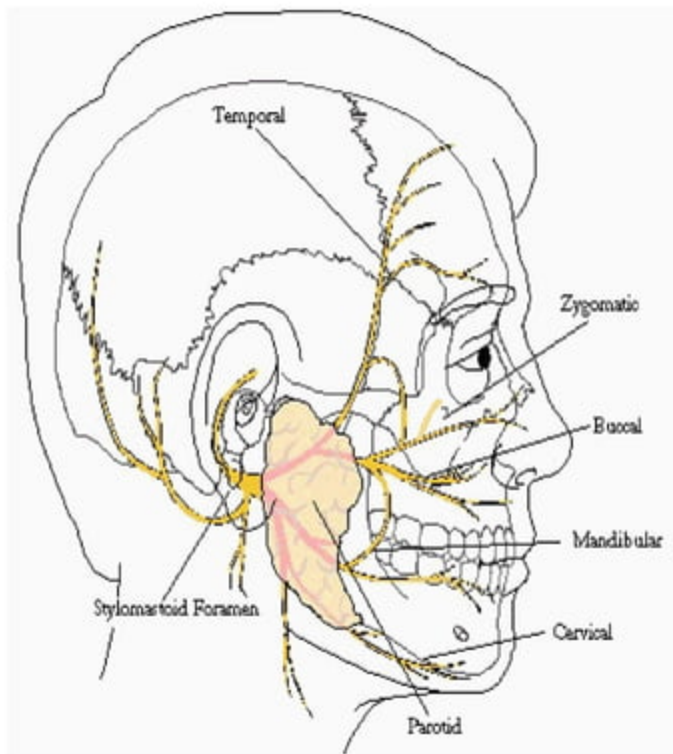
- Ophthalmic nerve (CN V₁) – sensory
- Maxillary nerve (CN V₂) – sensory
- Mandibular nerve (CN V₃) - mixed sensory and motor

Table 7.4. Nerves of the Face and Scalp



Motor nerves of the face

- Facial nerve (CN VII)



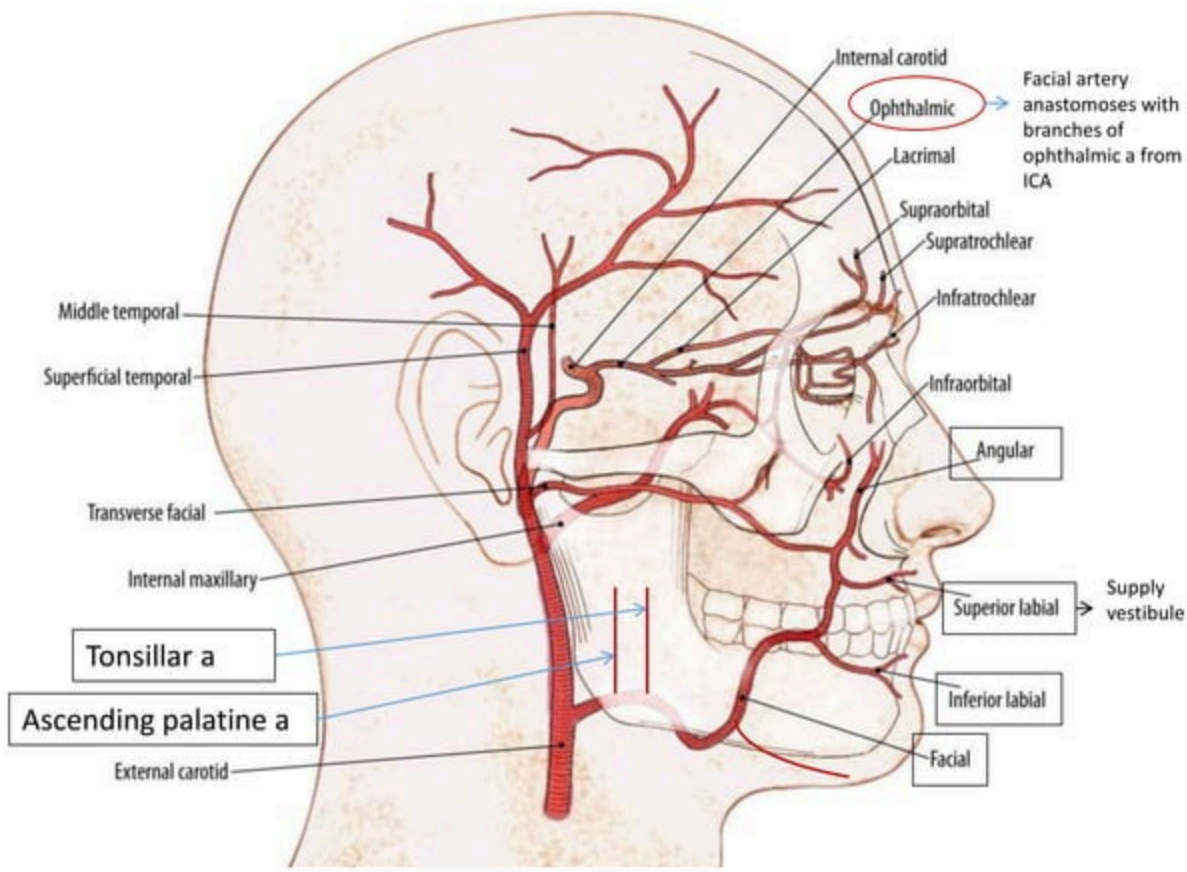
Blood Supply

- **Arteries**

- Facial artery
- Superficial temporal artery

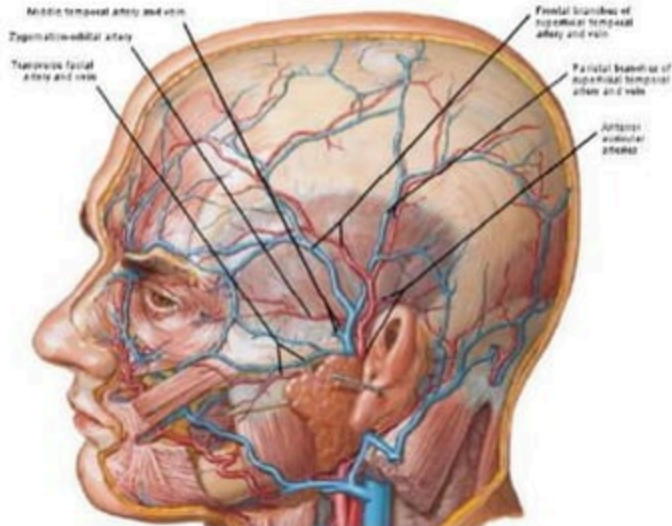
- **Veins**

- Superficial veins
- Deep veins



Superficial temporal artery

- Is the smaller terminal branch of the ECA
- Branches:
 - Transverse facial a.
 - Middle temporal a.
 - Zygomatico-orbital a.
 - Anterior auricular branch
 - Terminal branches – parietal and frontal aa.
 - Small branches to the:
 - Parotid gland
 - TMJ
 - Masseter muscle



Superficial veins of the face

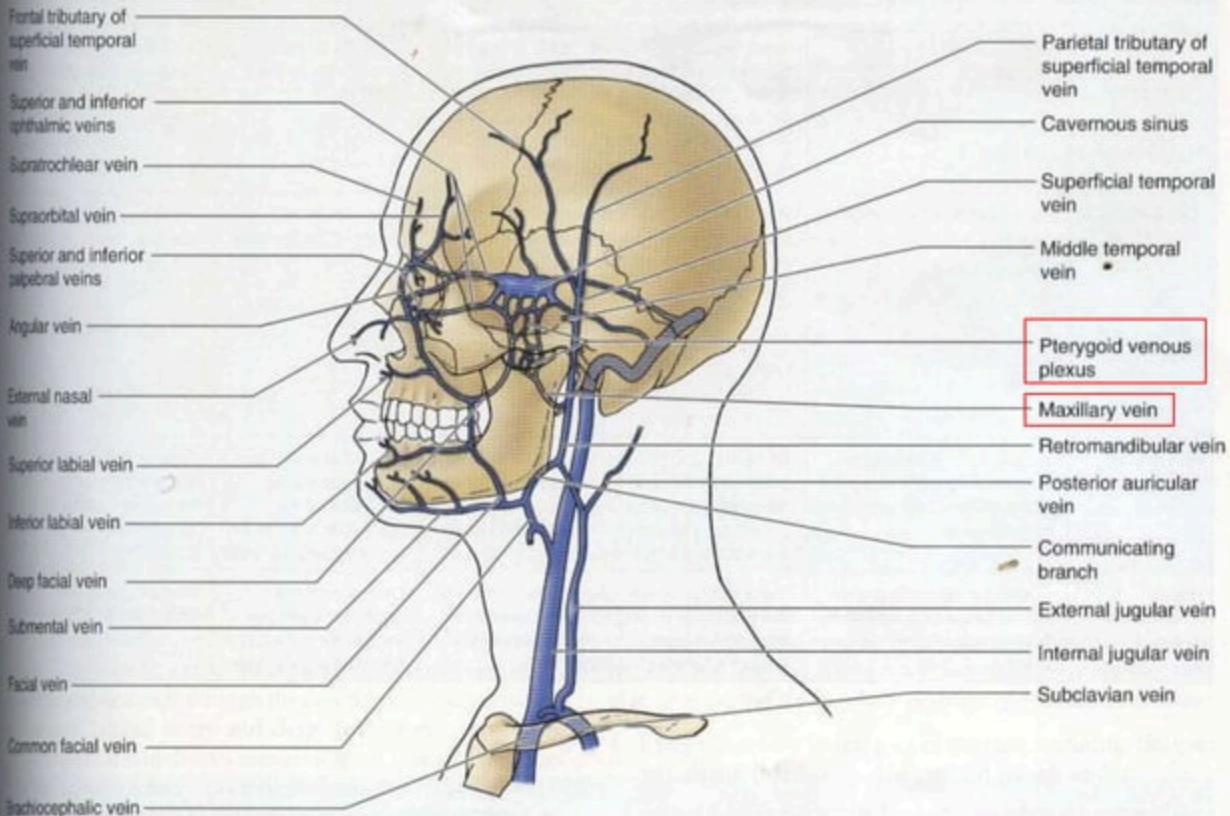
(Follows the course of artery)

- Facial v. and its tributaries:
 - Angular v.
 - Supratrochlear v.
 - Supraorbital v.
 - Deep facial v.
 - Superior and inferior labial vv.
 - External palatine v.
 - submental v.
 - Submandibular v.
- Superficial temporal v.
- Posterior auricular v.
- Occipital v.
- Retromandibular v.

Deep veins of the face

- Maxillary v.
- Pterygoid venous plexus
 - In the infratemporal fossa
 - Between the temporal and lateral pterygoid muscles

Table 7.6. Veins of the Face



Definition

- Maxillofacial trauma @ Facial trauma
- Defined as any physical trauma to the face including
 - Soft tissue injuries (burns, lacerations and bruises)
 - Fractures of the facial bones (nasal fractures, fractures of the jaw)
 - Trauma such as eye injuries

Aetiology

- Assaults (#1 in developed country)
- MVA – 70% d/t speeding (#1 in developing country)
- Falls
- Sport injury
- Industrial injuries
- Animal bites
- Burns
- War injuries

Initial Assessment and Management

- Primary Survey
- Secondary Survey

Primary Survey

- A - **airway** with cervical spine protection
- B - **breathing**
- C - **circulation** with haemorrhage control
- D - **disability** or neurological status
- E - **exposure** and **environment**

Secure the airway

Look, listen and feel for any signs indicating obstruction:

- 1) respiratory distress
- 2) decreased conscious level
- 3) noisy breathing/stridor

Cervical spine injury (primary concern) especially :

- Any patient with injury above clavicle resulting in unconscious state
- Any injury produced by high speed
- Neurologic deficit or Neck pain

Stabilization by :

- Manual immobilization
- Cervical collar, head support, and strapping



A : Airway maintenance with cervical spine protection



Chin lift

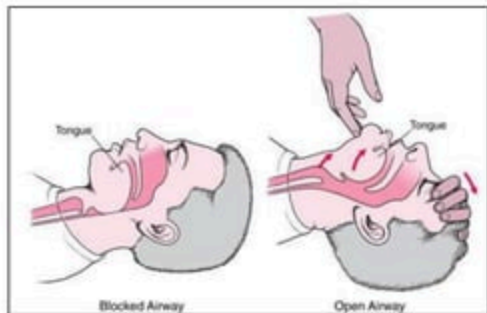
Jaw thrust

Tongue collapsed



Head tilt

Jaw thrust with neck extension.
Must NOT be performed

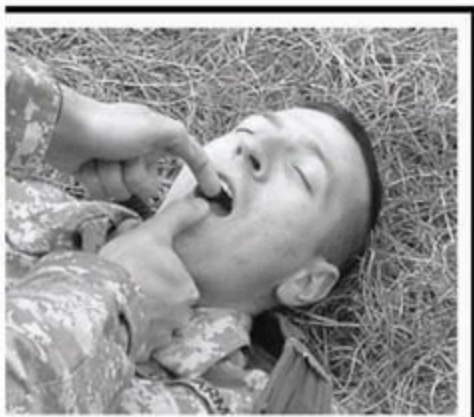


Blocked Airway

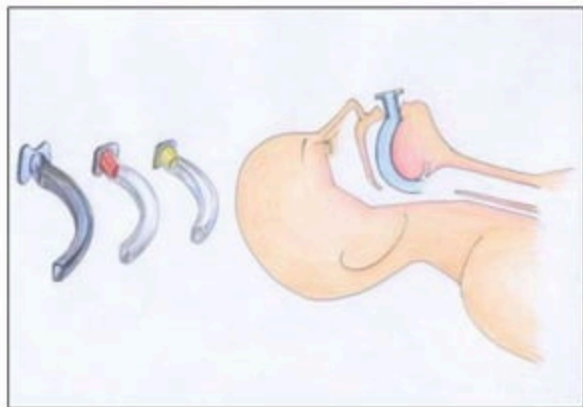
Open Airway

Material in the mouth that threatens the airway can be **removed manually** or using a **suction tool** for that purpose and **supplementary oxygen** can be provided.

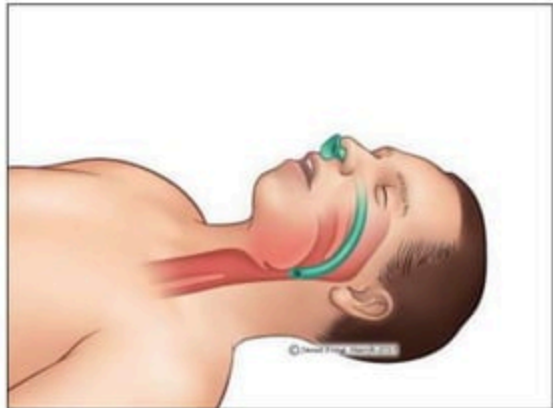
- Avulsed tooth
- Any secretions, vomitus or blood



Use of oropharyngeal or nasopharyngeal airway, supraglottic airway devices, tracheal intubation or surgical airway (cricothyrotomy or tracheostomy)



OP airway



NP airway

Breathing

- Only assess breathing after airway is secured
- Examined the chest:
 1. Inspection: adequate and symmetrical excursion, bruising, open wound, tachypnea
 2. palpation: position of trachea
 3. percussion: hyper-resonance/ dullness
 4. auscultation: abnormal/ absent breath sound

Circulation with Haemorrhage Control

- Assess by looking for external bleeding
- Visible signs of shock:
 1. pallor
 2. prolonged capillary refill
 3. clammy and cool skin
 4. tachycardia
 5. diminished/ absent pulse pressure

- External bleeding is controlled by direct pressure
- Two cannulae sited for administration of fluid and blood
- Blood sample can be drawn for baseline diagnostic tests and transfusion cross-matching
- Crystalloid intravenous fluid can be given to maintain the cardiac output

Disability

- Assessing patient's neurological status

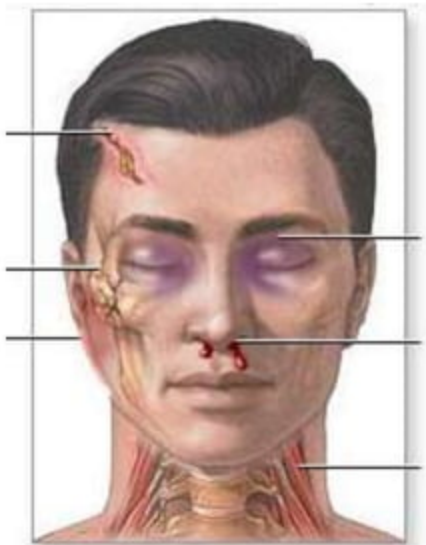
Glasgow Coma Scale		
BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	<i>Best response</i>	15
	<i>Comatose client</i>	8 or less
	<i>Totally unresponsive</i>	3

Exposure and Environment

- Enable full examination of the entire body surface

Secondary survey

(Detailed head to toe examination to identify any missed injuries)

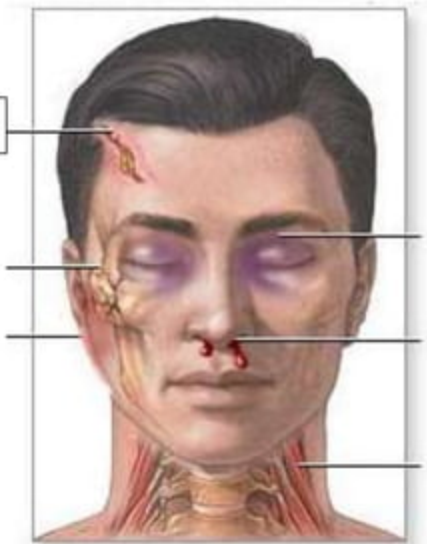


1. Look at overall facial appearance
2. Assess for symmetry, deformity, discoloration, nasal alignment
3. Palpate forehead & malar areas for tenderness in case any fractures

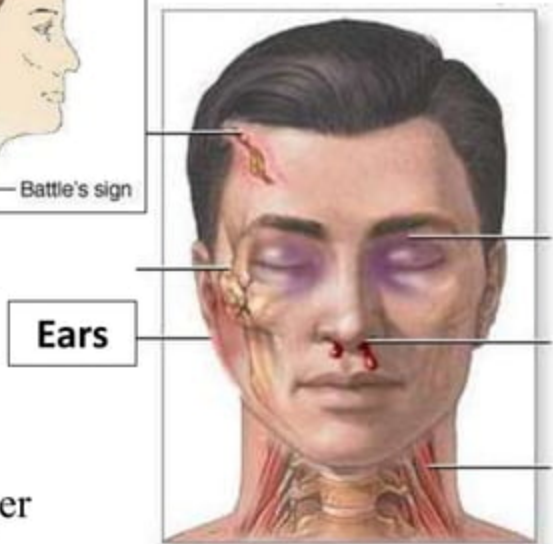
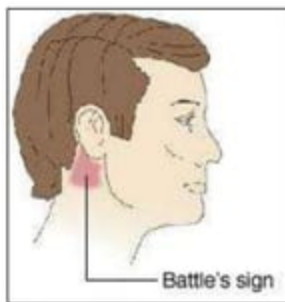
Check for :

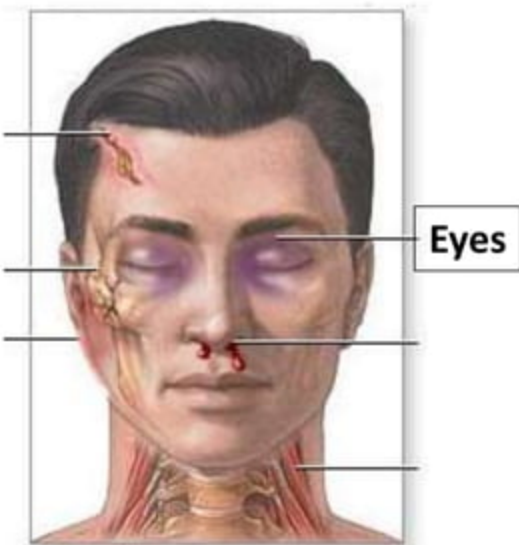
- tenderness
- abrasions
- lacerations
- hematomas

Scalp injury

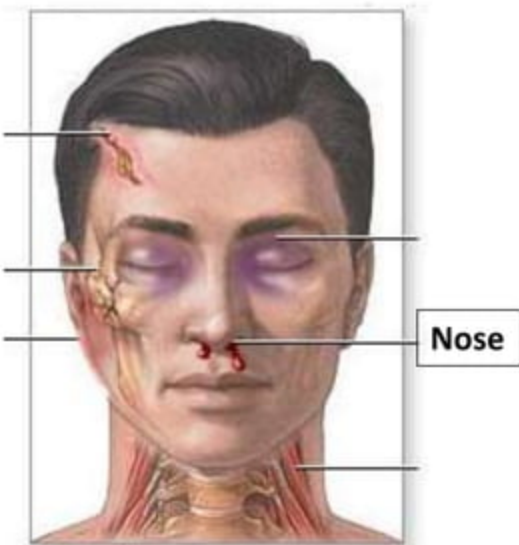


1. Examine
 - Pinnae
 - canal walls
 - tympanic membranes
2. Look for Battle's sign
 - Suction gently under direct vision if blood in canal
 - Put drop of canal fluid on filter paper for "ring sign" → CSF leak
3. Assess hearing

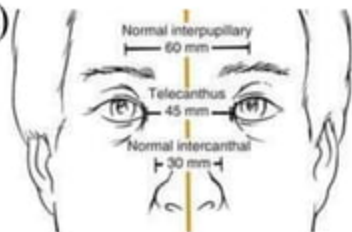




1. Any obvious trauma or bleeding?
2. Lid injury can leave cornea exposed
 - Protect with artificial tears or cellulose gel
3. Conjunctiva for foreign bodies
4. Pupillary reaction
5. Anterior chamber
 - Hyphema
6. Fundus
7. Extraocular movements
8. Vision
9. Any signs of periorbital ecchymosis?
10. Palpate orbital rims if do not suspect penetration of globe

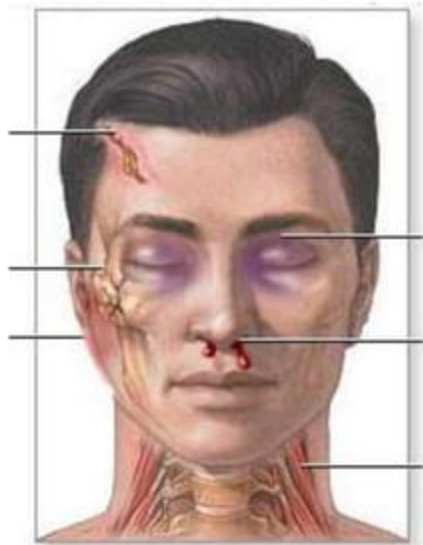


1. Any asymmetry?
2. Check septum for hematoma & position
3. Check airflow in both nares
4. Palpate nasal bridge for crepitus and tenderness
5. Check fluid or blood discharge on filter paper for “ring sign” (for CSF leak)
6. Measurement of the intercanthal distance (due to naso-orbital ethmoid injuries)



Neurologic

1. Motor function of facial muscles (CN VII) and muscle of mastication (CN V)
2. Sensation over the facial area (CN-V)
3. Sensation on tongue
4. Gag reflex



History approach

History can be obtained from the patient, or witnesses/ accompanying family members :

- How did the accident occur?
- When did the accident occur?
- What are the specifics of the injury:
(Type of the object contacted, direction of the contact?)
- Was there any loss of consciousness?
- What symptoms experienced by the patient:
(pain/ altered sensation/ visual changes/ malocclusion)
- Complete review of medical conditions, medication / allergies

Physical examination

- The face and cranium carefully inspected – any evidence of trauma : laceration, abrasion, contusions, area of edema/hematoma/ possible contour defect/ ecchymosis
 - * periorbital ecchymosis indicate orbital rim or zygomatic complex fractures
 - * Battle's sign (bruises behind ear) suggest basilar skull fracture
 - * ecchymosis in the floor of mouth indicate anterior mandibular fracture

<http://www.sciencedirect.com/science/article/pii/0030422056900251>

<http://emedicine.medscape.com/article/434875-overview>

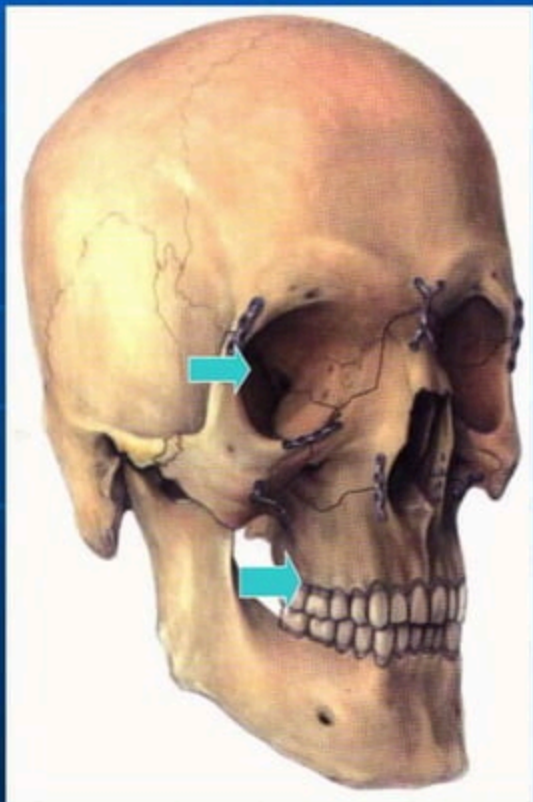
Mid face fracture

The face is divided into equal thirds :

- The upper face, from the hairline to the glabella. Fractures in this region involve the frontal bone and frontal sinus.
- The midface, from the glabella to the base of the columella. Fractures in this region involve the maxilla, nasal bones, nasoethmoidal complex (NOE), zygomaticomaxillary complex (ZMC), and orbital floor.
- The lower face, from the base of the columella to the soft tissue

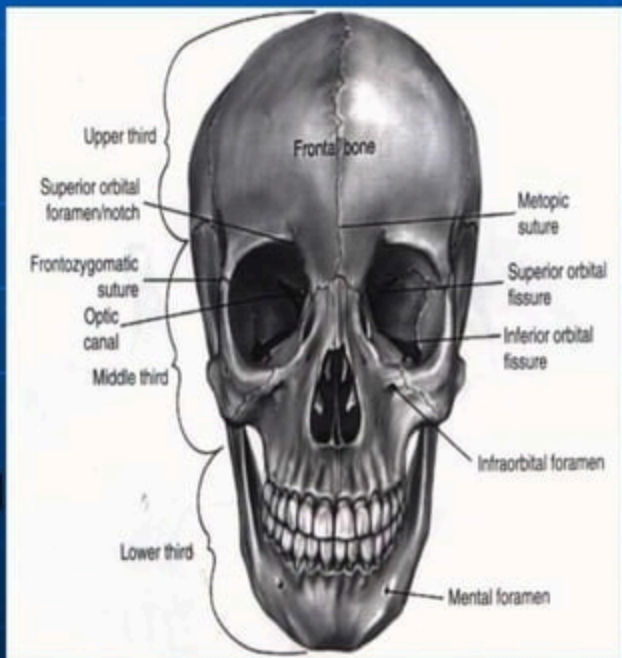
Definition:

The area between a superior plane drawn through the zygomatico-frontal sutures tangential to the base of the skull and inferior plane at the level of the maxillary dental occlusal surface



Structures connection (structures in relation)

- **Orbit**
- **Maxillary sinus**
- **Nasal bone**
- **Naso-orbital ethmoid (NOE) complex**
- **Zygomatic complex**
- **Frontal bone and sinus**



*** Area of strength**

- ✓ Vertical and horizontal pillars
- ✓ Muscular attachment

*** Area of weakness**

- ✓ Sutures
- ✓ Lining tissues and air-filled cavities

Evaluation of the Midface

- Evaluation of the midface :
 - ✓ **Alveolar fracture and dental fracture**
 - ✓ **Le Fort 's fracture (*french surgeon Rane Le Fort 1901*)**
 - ✓ **Naso-orbital ethmoid fracture**
 - ✓ **Zygomatic complex and arch fracture**
 - ✓ **Frontal sinus and bone fracture**
- Assessment of the mobility of the maxilla isolated structure/combination with the zygoma or nasal bones.

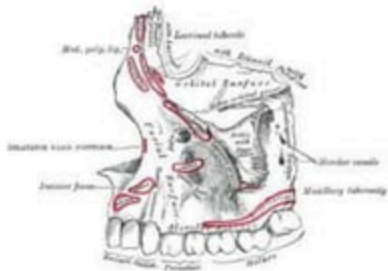


- ✓ Palpation for step deformities in the forehead/ orbital rim/ nasal/ zygoma areas.
- ✓ Evaluation of nose and paranasal structures by measurement of the intercanthal distance (between right and left median canthus).
- ✓ Nose is symmetrical or not ?
Bony anatomy – any deformity



Alveolar bone fracture

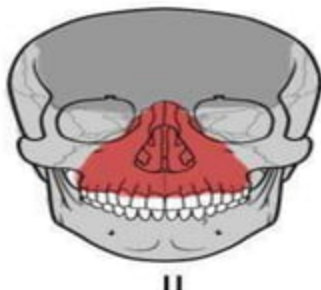
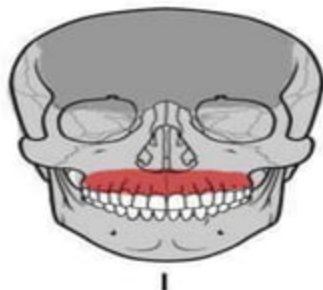
- The alveolar process (alveolar bone) is the thickened ridge of bone that contains the tooth sockets (dental alveoli) on bones that hold teeth. In humans, the tooth-bearing bones are the maxillae and the mandible.
- Alveolar fractures: These can occur in isolation from a direct low-energy force or can result from extension of the fracture line through the alveolar portion of the maxilla or mandible.
- Clinical findings include gingival bleeding, mobility of the alveolus, and loose or avulsed teeth.



Maxillary fracture

Maxillary fractures: These are classified as Le Fort I, II, or III

- LeFort I fracture is a horizontal maxillary fracture across the inferior aspect of the maxilla and separates the alveolar process containing the maxillary teeth and hard palate from the rest of the maxilla. The fracture extends through the lower third of the septum and includes the medial and lateral maxillary sinus walls extending into the palatine bones and pterygoid plates.
- LeFort II fracture is a pyramidal fracture starting at the nasal bone and extending through the ethmoid and lacrimal bones; downward through the zygomaticomaxillary suture; continuing posteriorly and laterally through the maxilla, below the zygoma; and into the pterygoid plates.
- LeFort III fracture or craniofacial disjunction is a separation of all of the facial bones from the cranial base with simultaneous fracture of the zygoma, maxilla, and nasal bones. The fracture line extends posterolaterally through ethmoid bones, orbits, and pterygomaxillary suture into the sphenopalatine fossa. See the image below :



Presentation of the maxillary fractures :

- Potential findings of LeFort I fracture include facial edema and mobility of the hard palate and maxillary alveolus and teeth.
 - Clinical presentations of LeFort II fractures include facial edema, telecanthus, subconjunctival hemorrhage, mobility of the maxilla at the nasofrontal suture, epistaxis, and possible CSF rhinorrhea.
 - Characteristic findings of LeFort III fractures include massive edema with facial rounding, elongation, and flattening. An anterior open bite may be present due to posterior and inferior displacement of the midfacial skeleton. Movement of all facial bones in relation to the cranial base with manipulation of the teeth and hard palate, epistaxis, and CSF rhinorrhea may also be found upon physical examination.
-
- <http://emedicine.medscape.com/article/434875-overview#a1>

Nasoethmoidal fractures (NOE):

- As the incidence of high-speed, high-force accidents has increased over the decades, so too has the number of such fractures. Due to the degree of force and the vectors involved, NOE fractures rarely occur as isolated events. Associated injuries often include central nervous system injury, cribriform plate fracture, cerebrospinal fluid rhinorrhea, and fractures of the frontal bone, orbital floor, and middle third of the face, as well as injury to the lacrimal system.

Zygomaxillary complex fractures (ZMC):

- These fractures result from direct trauma. Fracture lines extend through zygomaticotemporal, zygomaticofrontal, and zygomaticomaxillary sutures and the articulation with the greater wing of the sphenoid bone. The majority of these fractures result from trauma inflicted in altercations followed by MVA.

Frontal bone fractures

- Usually result from a high velocity blunt trauma to the forehead (e.g. MVA). The anterior and/or posterior table of the frontal sinus may be involved. More than one-third of patients with frontal sinus fractures are likely to have concomitant intracranial injury.

Mandibular fractures

- These can occur in multiple locations secondary to the U-shape of the jaw and the weak condylar neck. Fractures occur secondary to direct or indirect facial injury, including motor vehicle accidents, falls, sports, and assaults with blunt weapons or guns. Close to half of all patients with maxillofacial injuries have concomitant mandibular fractures.

Diagnosis

✓ History & Evaluation of Midface (PE)

✓ Investigation :

- **Laboratory studies**

Laboratory studies should be ordered based on the patient's medical history, current condition and planned surgical procedure.

- **Imaging studies**

CT scan is the gold standard imaging technique to diagnose maxillofacial fractures. The sensitivity and negative predictive values of a routine nonenhanced head CT scan for fracture surveillance was found to be 100%. However, when the patient sustains a low impact injury to the mandible, a panoramic x-ray should be the initial screening imaging technique.

Indications for treatment

- ✓ Physical signs of a fracture of the maxilla.
- ✓ Evidence of a fractured maxilla on imaging.
- ✓ Disruption of the occlusion of the teeth.
- ✓ Displacement of the maxilla.
- ✓ Post traumatic facial deformity.
- ✓ Fractured or displaced teeth.
- ✓ Cerebrospinal fluid leak.
- ✓ Abnormal eye movement or restriction of eye movement.
- ✓ Occlusion of the nasolacrimal duct.
- ✓ Sensory or motor nerve deficit.
- ✓ Other evidence of loss of function

Treatment

- General medical therapy: Administer oxygen and isotonic crystalloid fluids. Administer packed red blood cells if indicated. Check the tetanus status of the patient and administer indicated.
- Antibiotics: Administer antibiotics for open fractures until the fractures are repaired and the soft tissue wounds are closed.
- Pain management: Use oral medications for minor injuries and parenteral medications if the patient cannot take oral medications (ie, nothing by mouth [NPO]). For anti-inflammatory control, use ibuprofen, naproxen, or ketorolac (Toradol). For central control, use narcotics (eg, codeine, oxycodone, hydrocodone, meperidine, morphine).

Closed reduction may be appropriate in cases

- Simple uncomplicated fractures
- Complex or comminuted fractures
- Medical or surgical contraindications to open reduction
- Maxillary fractures in children

Open reduction may be appropriate where

- Immediate or early jaw function is desirable
- Difficulty is encountered in reducing the
- fracture by a closed method
- The fracture is unstable

Reduction

- **Manual manipulation**
- **Use of disimpaction forceps**

Extraoral fixation :

Craniomandibular fixation

- **Box-frame (pin fixation)**
- **Halo-frame**
- **Plaster of paries headcap**

Craniomaxillary fixation

- **Supra-orbital pins**
- **Zygomatic pins**
- **Halo-frame**

Immobilization within the tissue :

Direct fixation

- **Transosseous wiring at fracture sites**
- **Frontozygomatic sutures**
- **Infrorbital margin**
- **Midline of the palate**

Internal-wire suspension

- **Circumzygomatico-mandibular**
- **Infraorbital border-mandibular**
- **Frontomandibular**
- **Piriform fossa-mandibular**

Support via the maxillary sinus by filling materials

- **Ribbon gauze**
- **Balloon**
- **Folly catheter**
- **Polyethylene material**

<http://emedicine.medscape.com/article/434875-overview>



A Big
THANK
YOU!

A hand-drawn graphic featuring the text "A Big THANK YOU!" in a white, bubbly, outlined font. The word "THANK" is the largest and most prominent. To the left of the text is a large, hand-drawn red heart. The entire graphic is set against a light gray, circular glow on a white background.