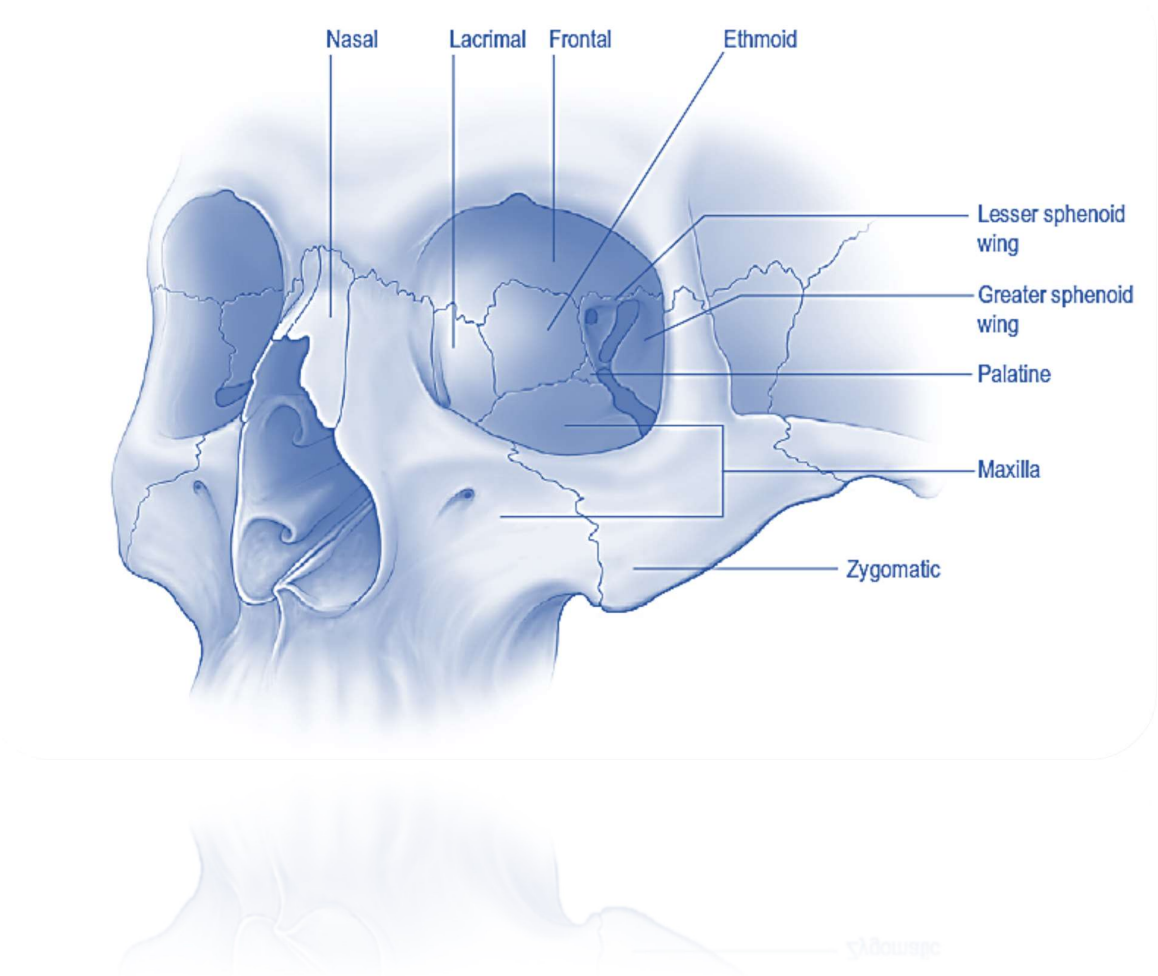
THE BONY ORBIT



OVERVIEW:

The eyeball is protected by a bony socket called the orbit on the two sides of the nose. The seven bones that make up the orbit are FS MZPEL (frontal, sphenoid, Maxilla, Zygoma, Palatine, Ethmoid and Lacrimal). The four-sided orbital cavity is pyramidal in shape with an open base in front and an apex on the back. The four walls of the orbit converge posteriorly to reach the apex on their back formed by the optic foramen.

Base: Opens out into the face, bounded by the orbital margins.

Walls: roof, floor, and medial and lateral walls.

Apex: Posterior, located at the opening of the optic canal, the optic foramen.

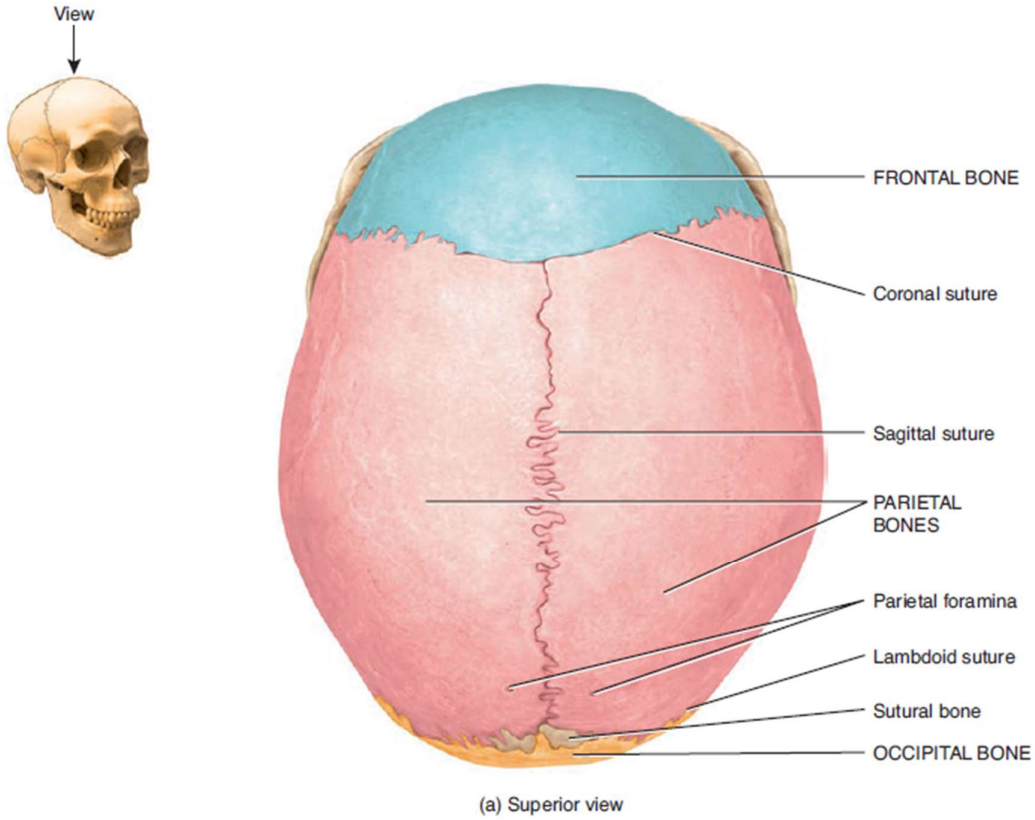
Entry Points: the optic canal, superior orbital fissure, and the inferior orbital fissure.

Sinuses: air-filled cavities in the bones; frontal, ethmoidal, sphenoid, and maxillary

BONES OF THE SKULL

The skull has 22 bones divided into cranial and facial bones. We start our discussion here because the bones of the orbit are made of 7 different bones from the cranium and the face. The bones of the skull protect the brain. There are 8 cranial bones and 14 facial bones.

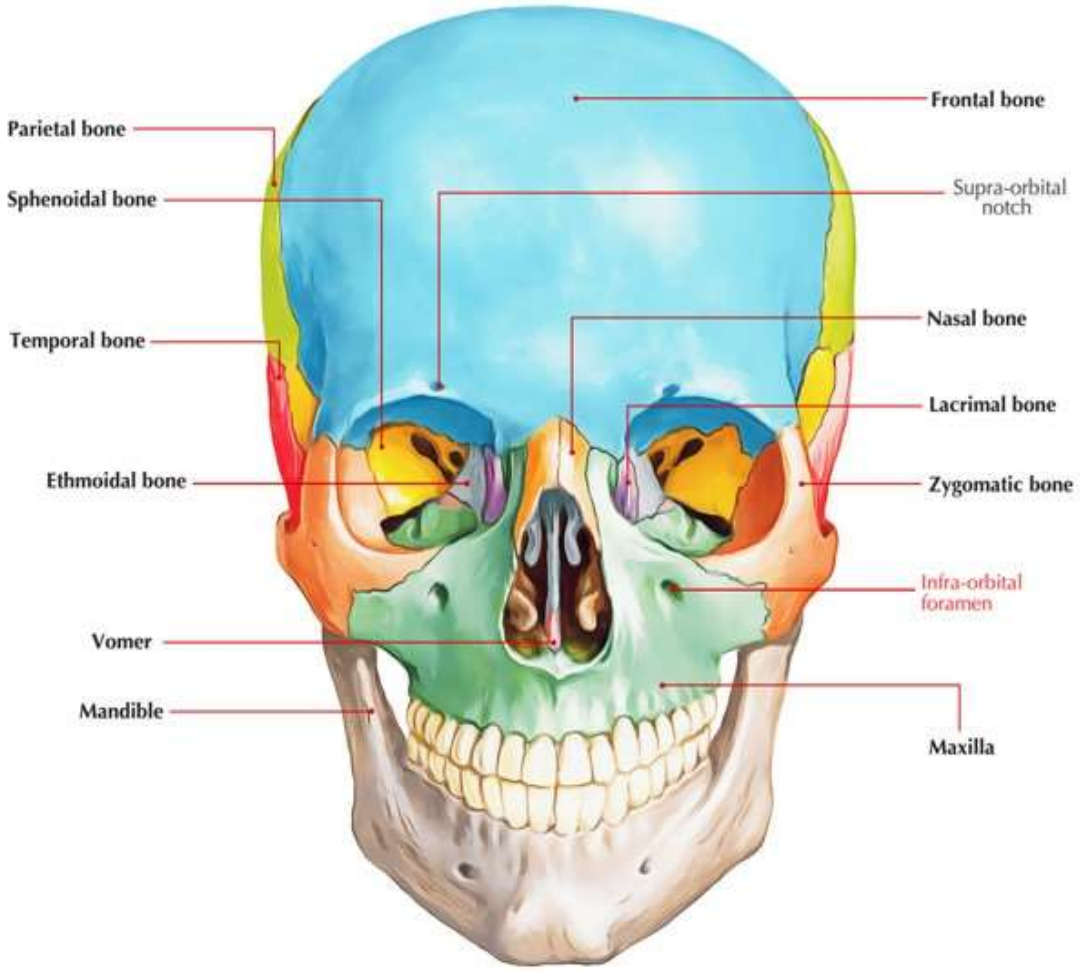
Cranial Bones: Frontal, Parietal (2), Temporal (2), Occipital, Sphenoid and Ethmoid



(a) Superior view

The 14 facial bones are; Frontal bone, Maxilla, Mandible, Zygoma, Palatine bones, Lacrimal bones, nasal bones, vomer and inferior nasal conchae. Out of the skull bones, only mandible and auditory ossicles

are movable.



BONES OF THE ORBIT

The orbits are two bony cavities on either side of the mid-sagittal plane below the anterior cranium that houses the eyeball. It houses other structures such as the extraocular muscles, nerves, lacrimal apparatus, fat and blood vessels. The bony orbit is shaped like a four-sided pyramid comprising of an apex and four walls.

Three cranial bones form part of the orbit: the frontal, sphenoid, and the ethmoid bones. The rest are facial bones—maxillary, zygomatic, palatine, and lacrimal bones. The lacrimal bone is the smallest bone of the face and articulates with maxillary bone, ethmoid and frontal bones.

1. Frontal bone
2. Sphenoid
3. Maxilla
4. Zygoma

5. Palatine
6. Ethmoid
7. Lacrimal

Mnemonic: FS MZPEL

Out of the 7 orbital bones, 3 are single; ethmoid, frontal and sphenoid (EFS). The rest are paired, 1 in each orbit.

BASE OF THE ORBIT

The base or front of the orbits is formed by 2 margins each. The supraorbital margin which is a thick ridge of the frontal bone and the inferior orbital margin. The inferior orbital margin is formed laterally by the zygomatic bone and medially by part of the maxilla. The cavity is often compared to the shape of a pear whose stalk is formed by the optic canal. Its medial walls are parallel to each other.

ORBITAL WALLS

The bony orbit is bounded by 4 walls; roof, floor, lateral and medial walls.

The Orbital Roof

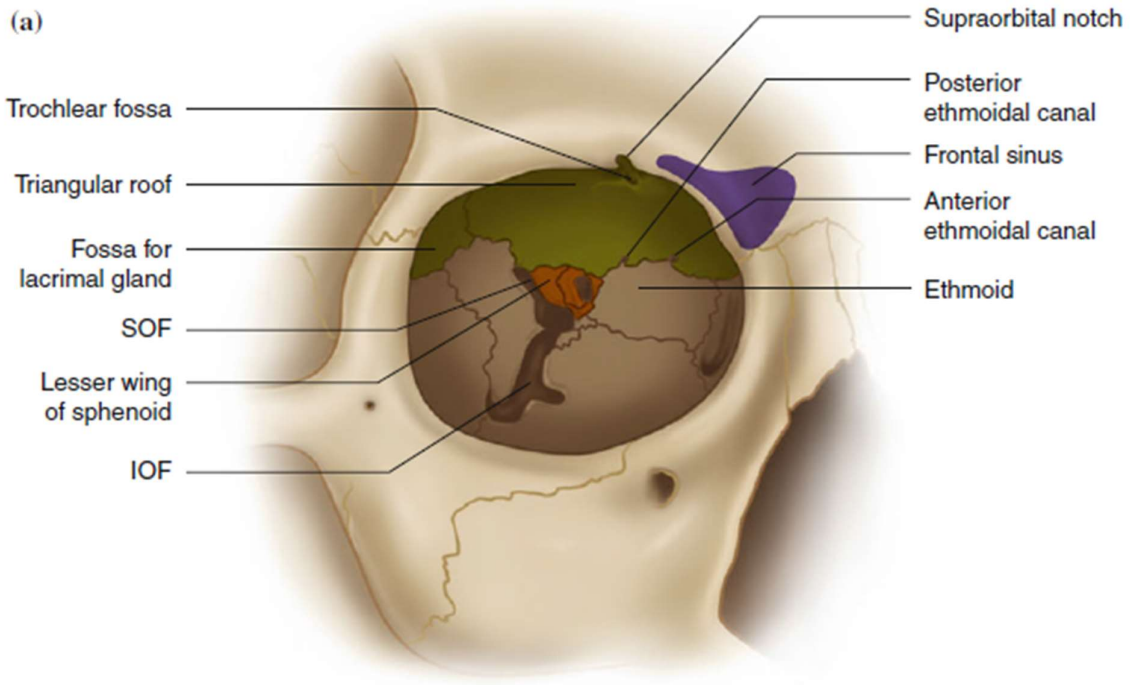
The orbital roof is triangular and composed of;

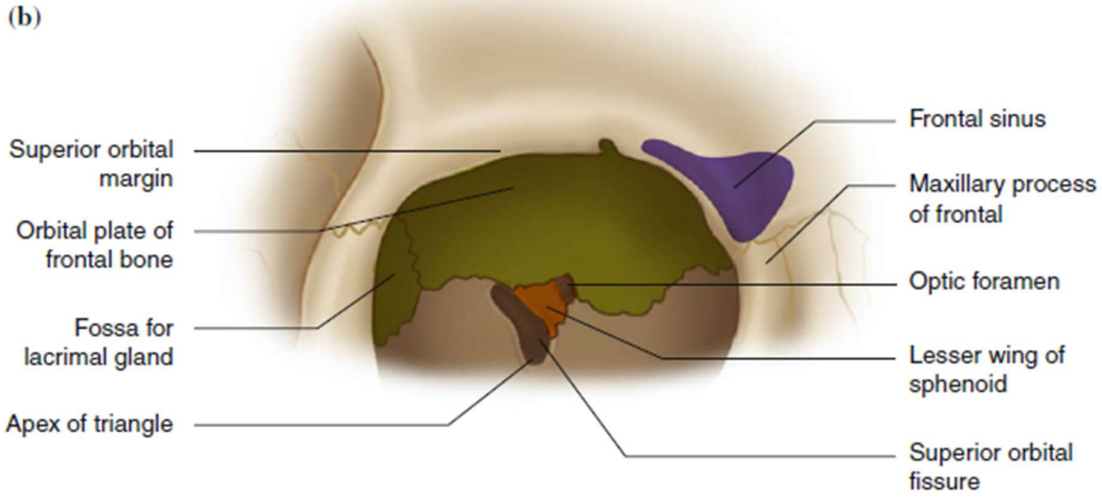
1. Orbital plate of the frontal bone. (anterior)
2. Lesser wing of the sphenoid bone. (posterior)

Mnemonic: rooFLeS.

- Frontal bone forms the ridge of the superior orbital margin.
- Cartilaginous u-shape structure called trochlear attached to the frontal plate.

- Tendon of the superior oblique muscle passes through the trochlear at its inflection.





CLINICAL NOTES: Refer to Orbital Rim Fracture in the clinical notes.

The Orbital Floor

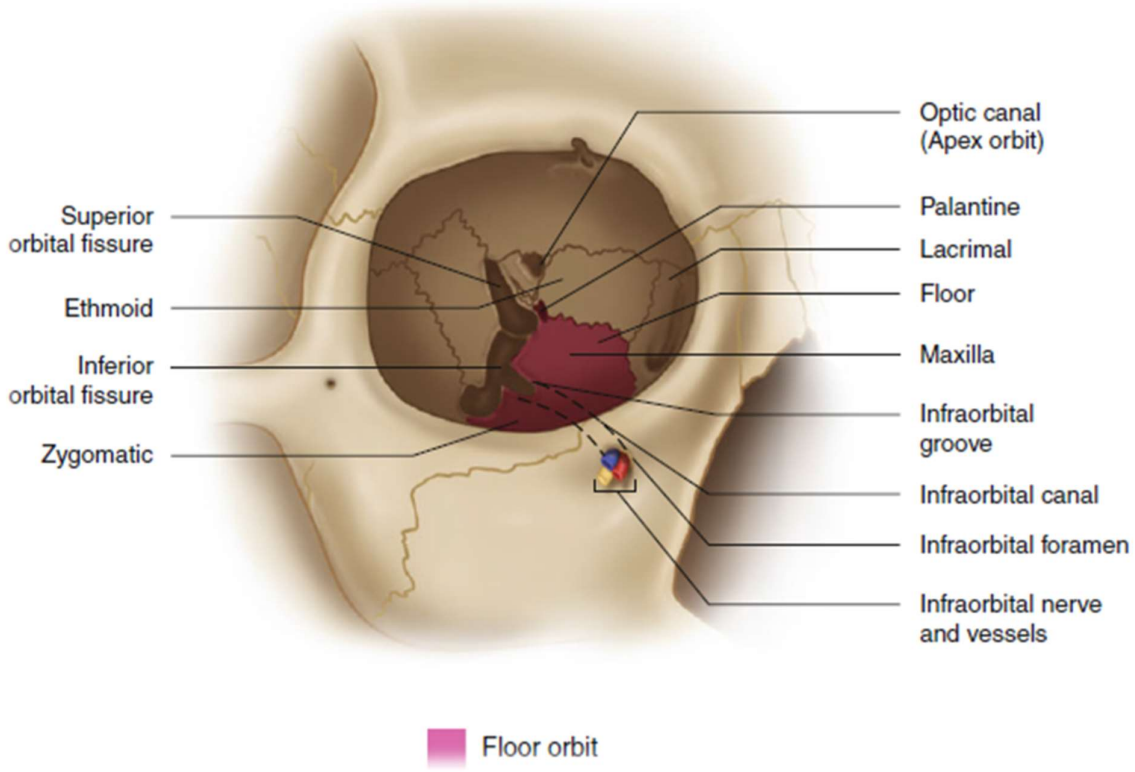
The orbital floor is also triangular and made up of:

1. Orbital plate of maxillary bone
2. Orbital plate of zygomatic bone

3. Small orbital process of the palatine bone.

Mnemonic: ZYGMAP.

- Maxillary bone makes up most of the floor with largest part of the rest made of the zygoma.
- Floor is separated from the lateral wall by the inferior orbital fissure.
- The floor is the shortest of the walls.



CLINICAL NOTES: Refer to Blow Out Fracture in the clinical notes.

The Medial Wall

The medial wall is rectangular and formed by:

1. Frontal process of the maxilla
2. The lacrimal bone
3. Orbital plate of the ethmoid
4. A part of the body of the sphenoid.

- The ethmoid bone forms most of the medial wall.

- The orbital plate of the ethmoid is sometimes said to be “paper thin” (lamina papyracea)

- The medial wall is the thinnest of the orbital walls but the least prone to fracture due to support of the honeycombed structure of the ethmoid bone

- The lacrimal sac lies in the lacrimal fossa

- The thickness of the fossa allows easy penetration of needle during dacryocystorhinostomy

- The anterior and posterior ethmoidal canals are located within the frontoethmoidal suture.

The Lateral Wall

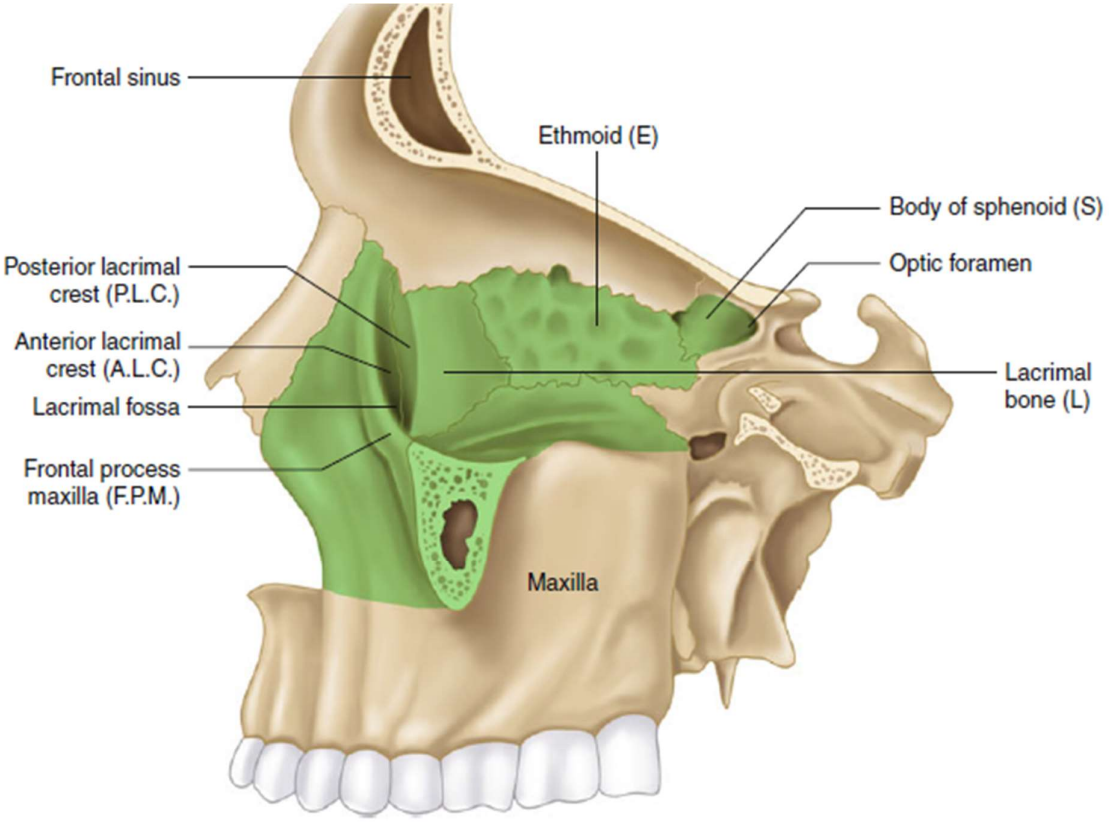
Roughly triangular composed of:

1. Zygomatic bone anteriorly

2. Greater wing of the sphenoid posteriorly

3. The zygoma separates the orbit from the temporal fossa.

- One or more foramina may be present, serving as a conduit for nerves and blood vessels between face and orbit.

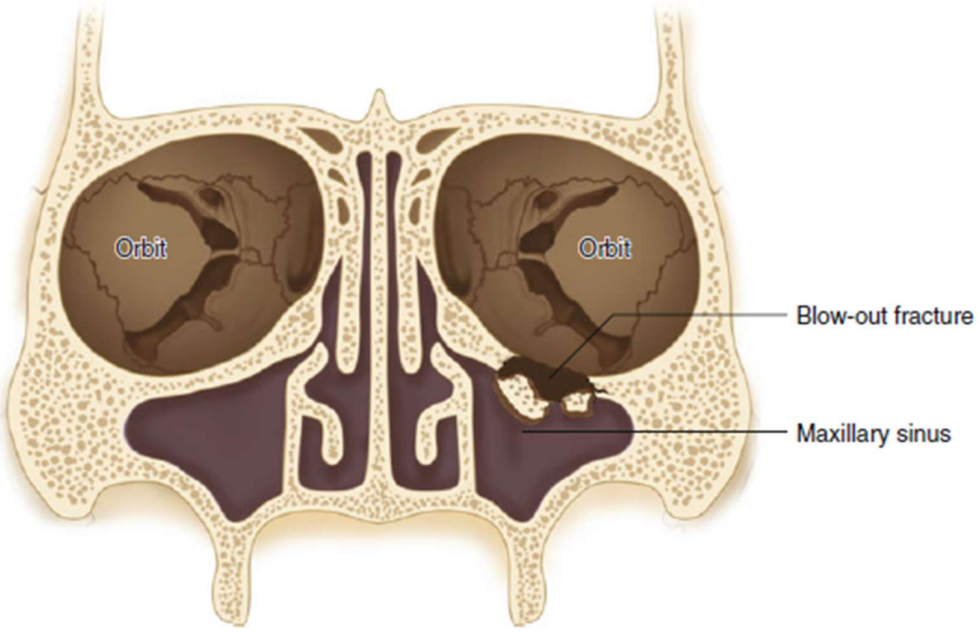


- The lateral wall is directed posteriorly and allows for a wide field of view but makes the eye prone to injury.
- The zygomaticosphenoidal suture is the thinnest portion of the lateral wall and a good point of entry during lateral orbitotomy
- The lateral (marginal) orbital tubercle is a small bony prominence located on the orbital surface of zygoma. It is the attachment for
    - the aponeurosis of the levator palpebrae superioris
    - lateral palpebral ligament
    - lateral check ligament.
- Greater wing of the sphenoid separates the orbit from the middle cranial fossa.
- The roof is separated from the lateral wall in back by the superior orbital fissure and in front by the frontozygomatic and frontosphenoidal sutures.
- The inferior orbital fissure separates the posterior part of the floor from the lateral wall.

CLINICAL NOTES: Refer to ZMC in the clinical notes section.

WEAK SPOTS IN THE ORBIT

The infraorbital groove and canal constitute weak spots in the floor of the orbit. Another weak spot, as shown in is the thin bone ethmoid, which separates the eye from the medial wall. Ethmoiditis in children may give rise to orbital cellulitis, and severe contusion injuries can cause rupture of the medial wall and periorbital crepitus. The lacrimal fossa in the medial wall is also a weak spot. The fossa lies between the anterior and posterior lacrimal crests and lodges the lacrimal sac, which is continuous below with the nasolacrimal duct. The duct's lower end opens into the inferior meatus of the nose for drainage of tears when severe emotional stress occurs.

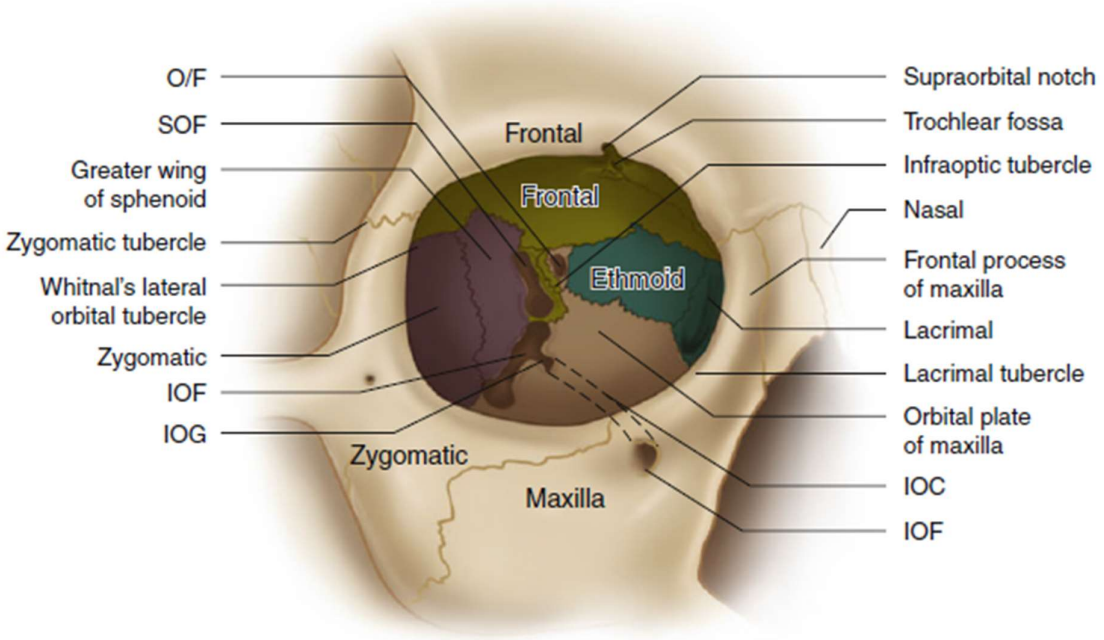


ORBITAL MARGINS

Although dimensions of the orbit vary widely, the average horizontal diameter of the orbital margin is 4 cm, the average vertical diameter is 3.5 cm, and the average depth is 4.5 cm. The frontal bone forms the superior orbital margin. The highest point of this arch is

supraorbital notch. and is the conduit for the supraorbital vessels and nerves.

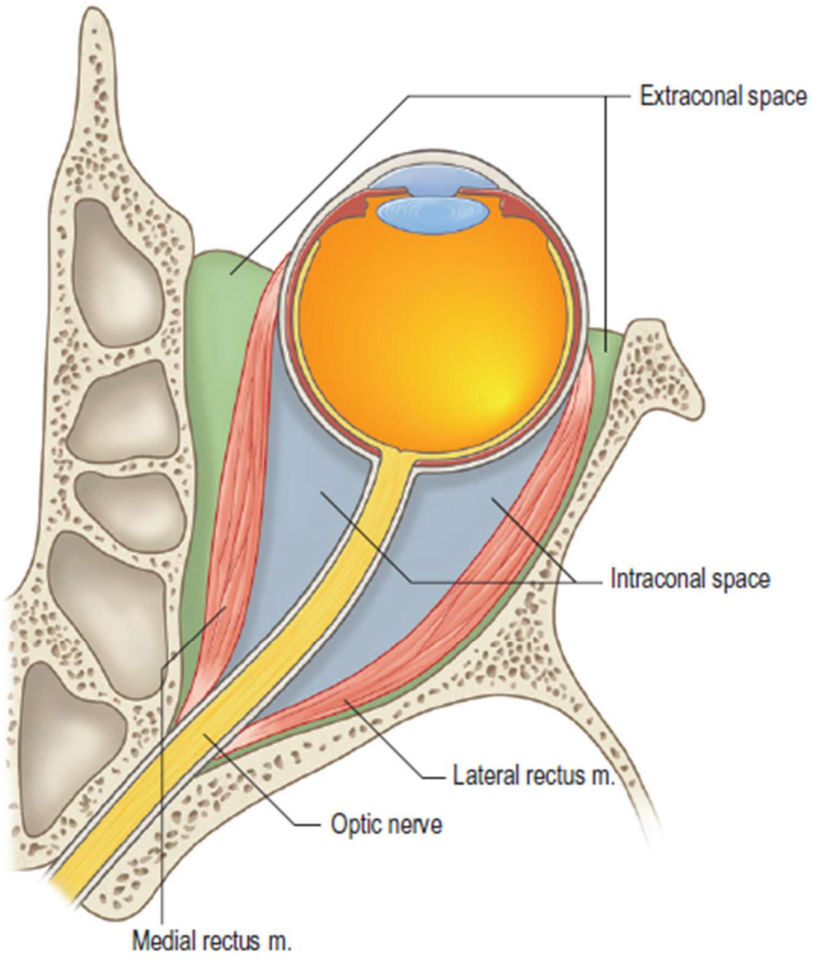
The lateral orbital margin is the orbital region most exposed to possible injury and therefore is the strongest area of the orbital margin. It is formed by the zygomatic process of the frontal bone superiorly and by the frontal process of the zygomatic bone inferiorly.



Base of orbit quadrangular in front
At apex orbit
On back – O/F - Optic foramen
SOF - Superior orbital fissure
IOF - Inferior orbital fissure
In floor orbit – IOG - Infraorbital groove
IOC - Infraorbital canal
IOF - Infraorbital foramen

ORBITAL APEX

It is the entry site of all the nerves & blood vessels to the eye and all the extraocular muscles except the inferior oblique. This lies near the medial end of the superior orbital fissure and contains the optic canal. The superior and inferior orbital fissures and the optic canal open into the orbit. They transmit important nerves and vessels.

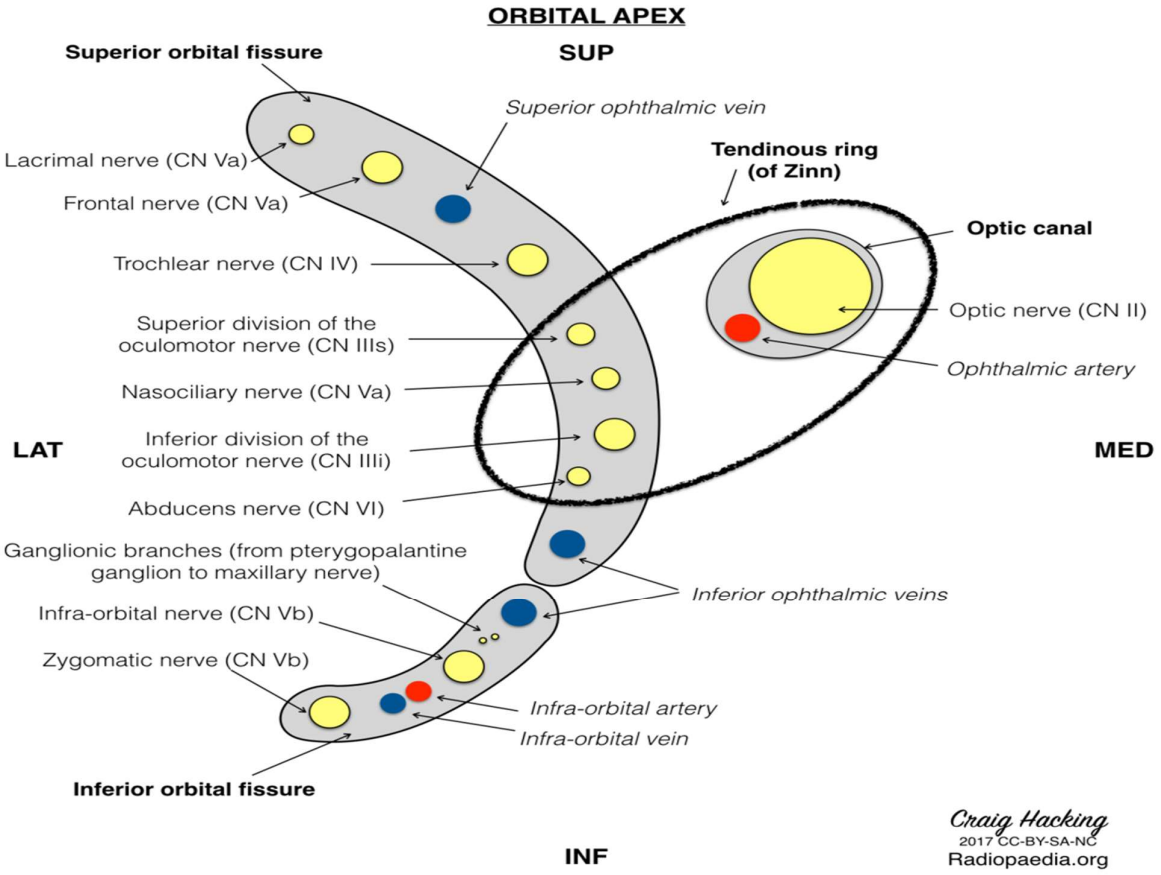


PATHWAYS INTO THE ORBIT

There are three main pathways by which structures enter or leave the orbit—the optic canal, superior and inferior orbital fissure.

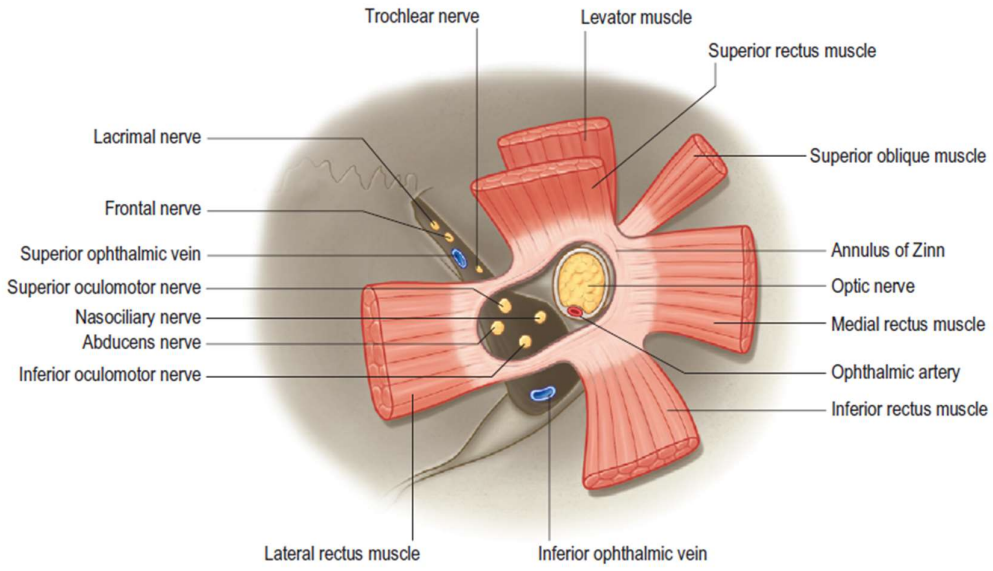
The Optic Canal

The optic canal conveys the optic nerve and ophthalmic artery from the optic canal into the orbit. The canal is housed in the lesser wing of the sphenoid bone with a contribution from the inferomedial optic strut. It runs 8–10 mm in length and is 5–6 mm in diameter. The optic canal and foramen attain adult dimensions by 3 years and are symmetric in most persons. A canal/foramen that is larger in diameter by at least 1 mm than the contralateral side may be considered abnormal.



Superior Orbital Fissure

This is the gap between the lesser wing and the greater wing of the sphenoid. It is located between the roof and the lateral wall. It connects the middle cranial cavity with the orbit. A circular band of connective tissue, the common tendinous ring or ANNULUS OF ZINN is located anterior to the fissure and optic canal. The ring is the origin of the four rectus muscles.



Structures that enter the orbit within the annulus:

1. Inferior division of the oculomotor nerve
2. Nasociliary nerve
3. Abducens nerve.
4. Superior division of the oculomotor nerve

Mnemonic: INAS

Vessels and Nerves enter the orbit outside the annulus.

1. Lacrimal nerve
2. Frontal nerve
3. Trochlear nerve
4. Superior ophthalmic vein

Mnemonic: LaFTS

Inferior Orbital Fissure

It is bounded above by the greater wing of the sphenoid, below by the maxilla, the palatine and laterally by the zygoma. The fissure connects the orbit with the pterygopalatine and infratemporal fossa.

Vessel and Nerve

- Infraorbital and zygomatic branches of the maxillary nerve
- Inferior ophthalmic vein.

PARANASAL SINUSES

Paranasal sinuses are cavities within the bones that form the skull and the orbit. They include;

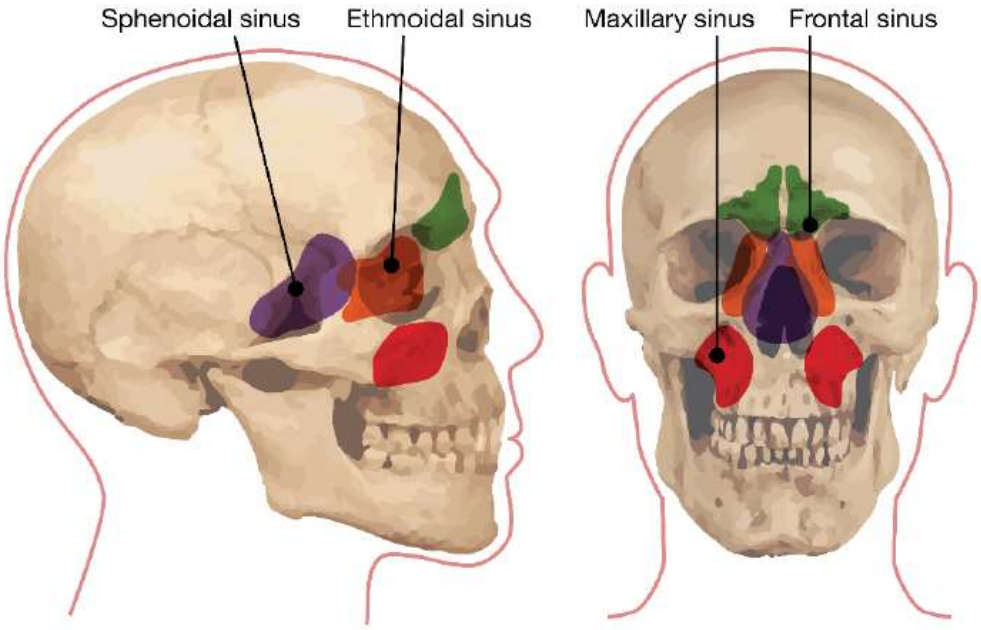
1. Frontal sinus
2. Ethmoidal sinus
3. Sphenoid sinus
4. Maxillary sinus

Features:

1. They are lined by mucous membranes
2. Air-filled

Functions

1. Warm and moisten air
2. Lighten the skull
3. Add resonance to voice



CLINICAL NOTES: Refer to Orbital Cellulitis in clinical notes section

Compiled by: Paul Owusu