



Cranial cavity

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This is the first and last time in your life, you will hear that there is an artery within a vein ^
>> artery pulsations help the blood flow within the sinus & prevent blood stagnation within the sinus

Important Structures Associated With the Cavernous Sinuses

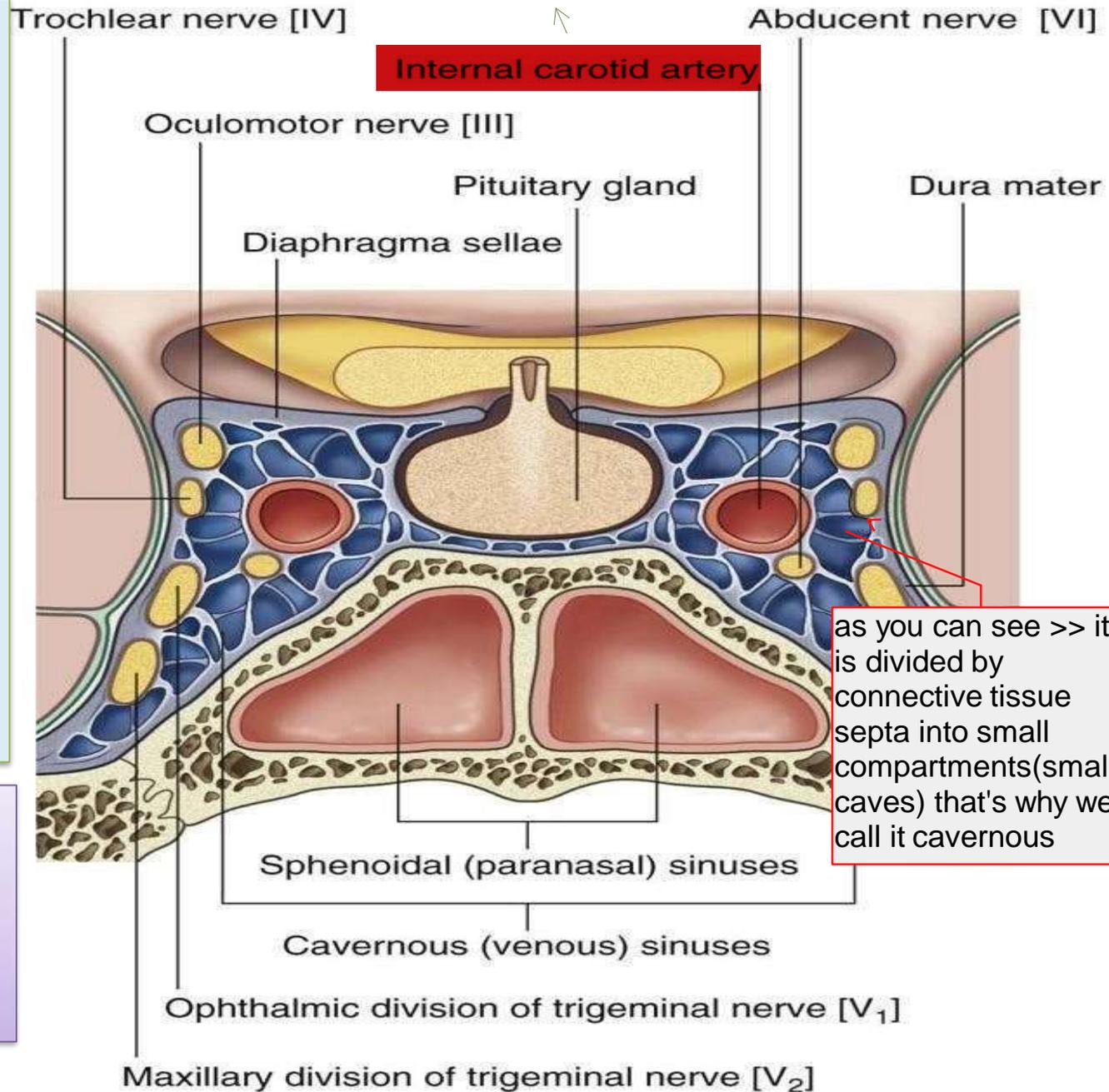
- 1-Internal carotid artery
- 2-Sixth cranial nerve

In the lateral wall

- 1- Third cranial nerve
- 2- Fourth cranial nerve
- 3- Ophthalmic and maxillary divisions of the fifth cranial nerve
- 4-The pituitary gland, which lies medially in the sella turcica

Note:

The mandibular division is not associated with cavernous sinus
!!!!!!!!!!!!!!!!!!!!!!!!!!!!



as you can see >> it is divided by connective tissue septa into small compartments (small caves) that's why we call it cavernous

These veins are valveless, if there is an infection in the face, it will be transmitted to cavernous sinus by two pathways:
short pathway: facial V >> ophthalmic Vs > superior orbital fissure >> cavernous sinus.
long pathway: facial V >> deep facial V >> pterygoid venous plexus >> emissary V >> cavernous sinus.

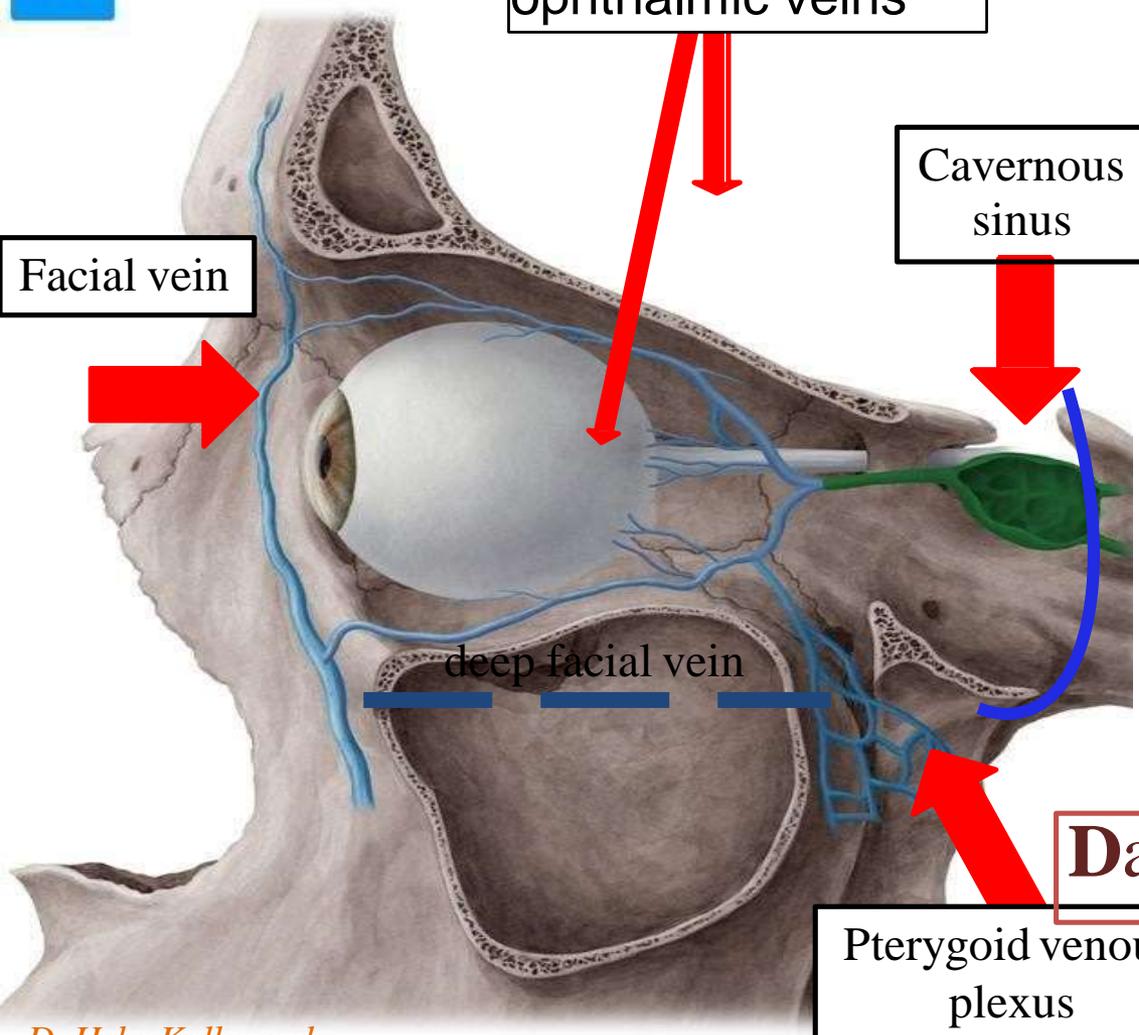
cavernous sinus syndrome (thrombosis within cavernous sinus) :(
 >> will result with stagnation of blood flow within cavernous sinus >> Venous drainage will reduce.



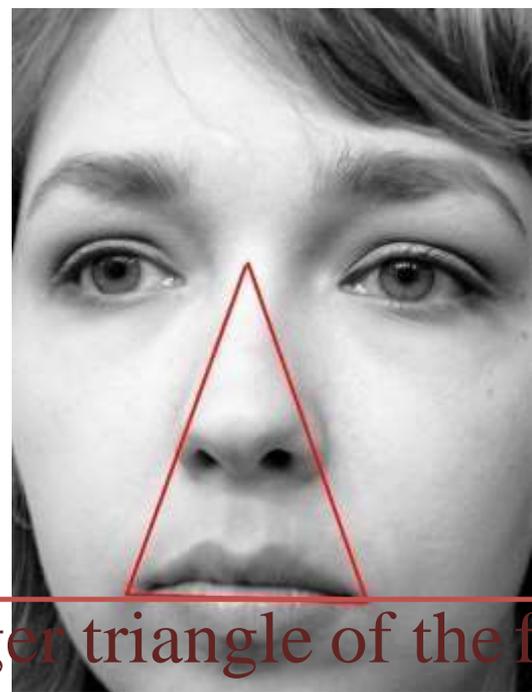
superior & inferior ophthalmic veins

Cavernous sinus

Facial vein



Note: venous communication (via the ophthalmic veins) between the **facial vein** and the **cavernous sinus**



Danger triangle of the face

Pterygoid venous plexus

Cavernous sinus syndrome

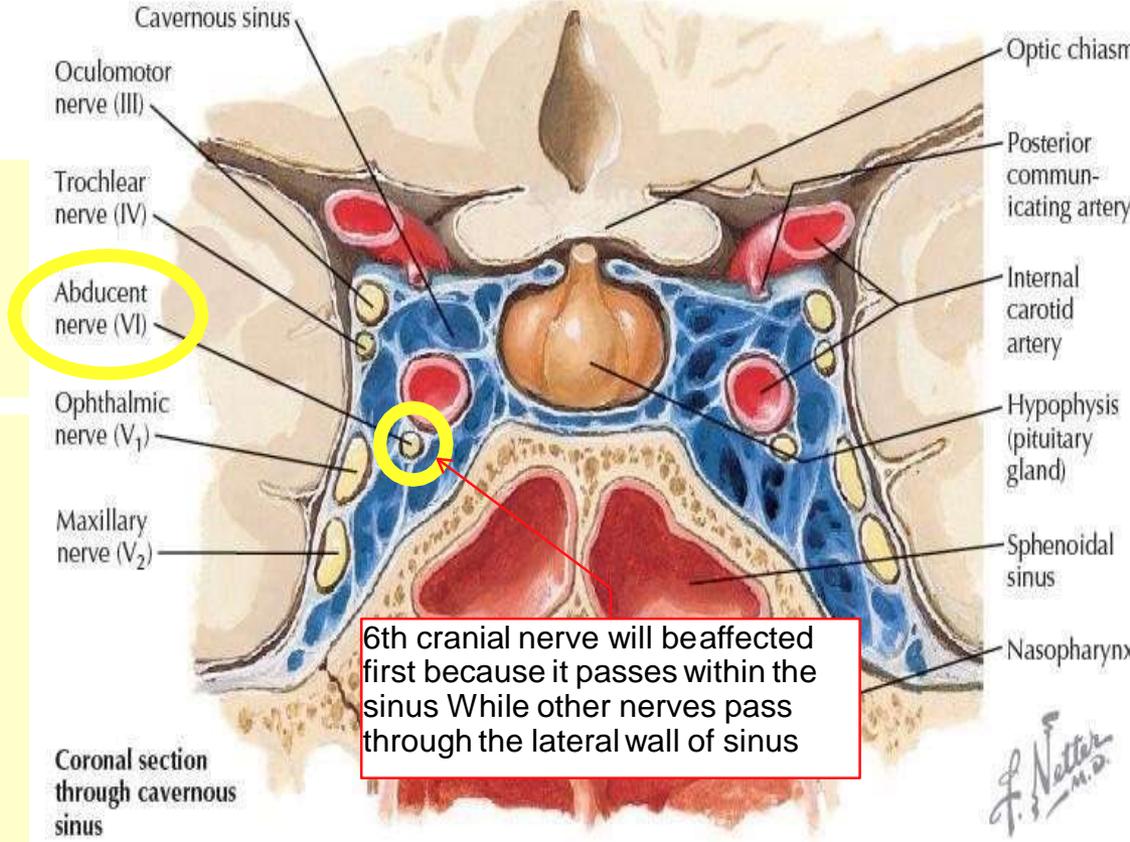
Cavernous sinus syndrome

Can result from sepsis from the central portion of the face or paranasal sinuses

Clinical manifestations:

- Ophthalmoplegia with diminished pupillary light reflexes
- Venous congestion leading to periorbital edema
- Exophthalmos
- Pain or numbness of the face

due to compression the ophthalmic & maxillary nerves



Subsequent infection or inflammation in the cavernous sinus can result in damage to any of the cranial nerves that pass through it

Exophthalmos is a bulging of the eye anteriorly out of the orbit

due to reducing Venous drainage >> this will result in accumulation of interstitial fluid within the orbit >> **periorbital edema** >> bulging the eye anteriorly > because the orbit is a closed area except anteriorly.

Ophthalmoplegia is the paralysis or weakness of the eye muscles

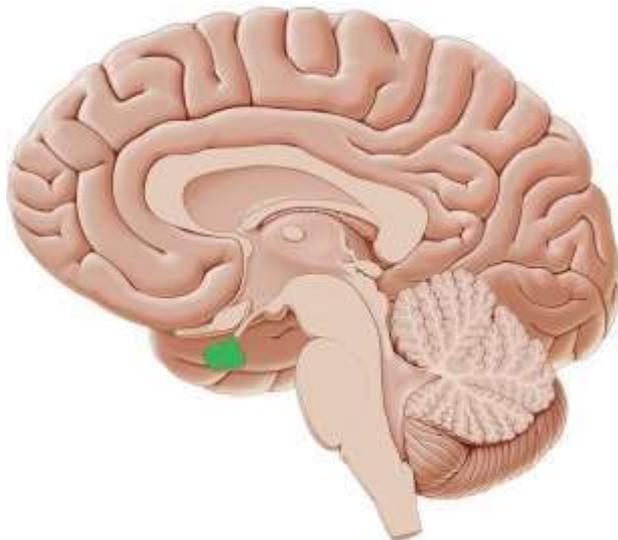
due to compression the nerves (3th & 4th & 6th) which is passing through the cavernous sinus



Pituitary Gland

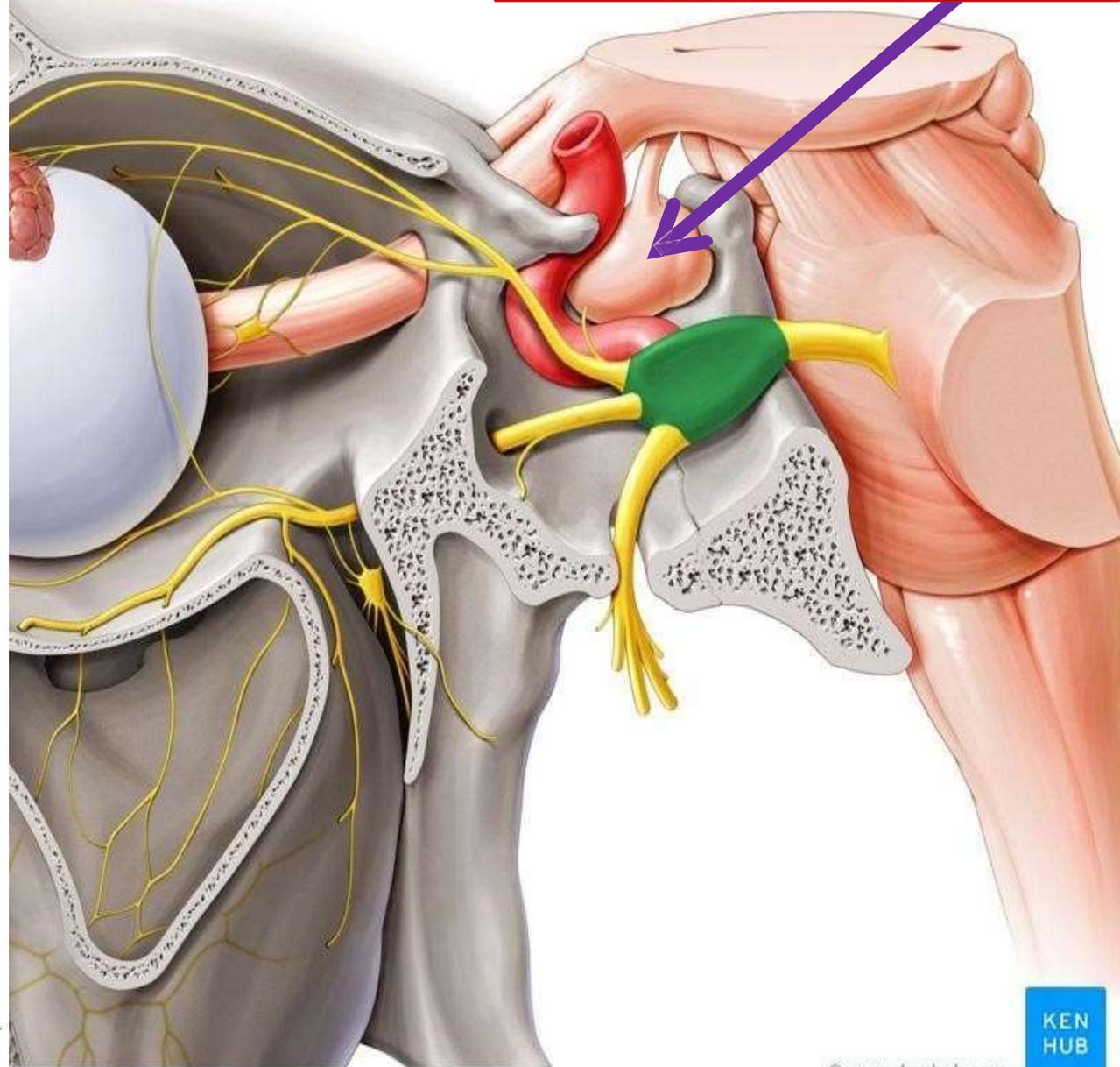
The pituitary gland is a small, oval structure attached to the undersurface of the brain by the **Infundibulum**

The gland is well protected in the sella turcica of the sphenoid bone



Hypophysis Cerebri

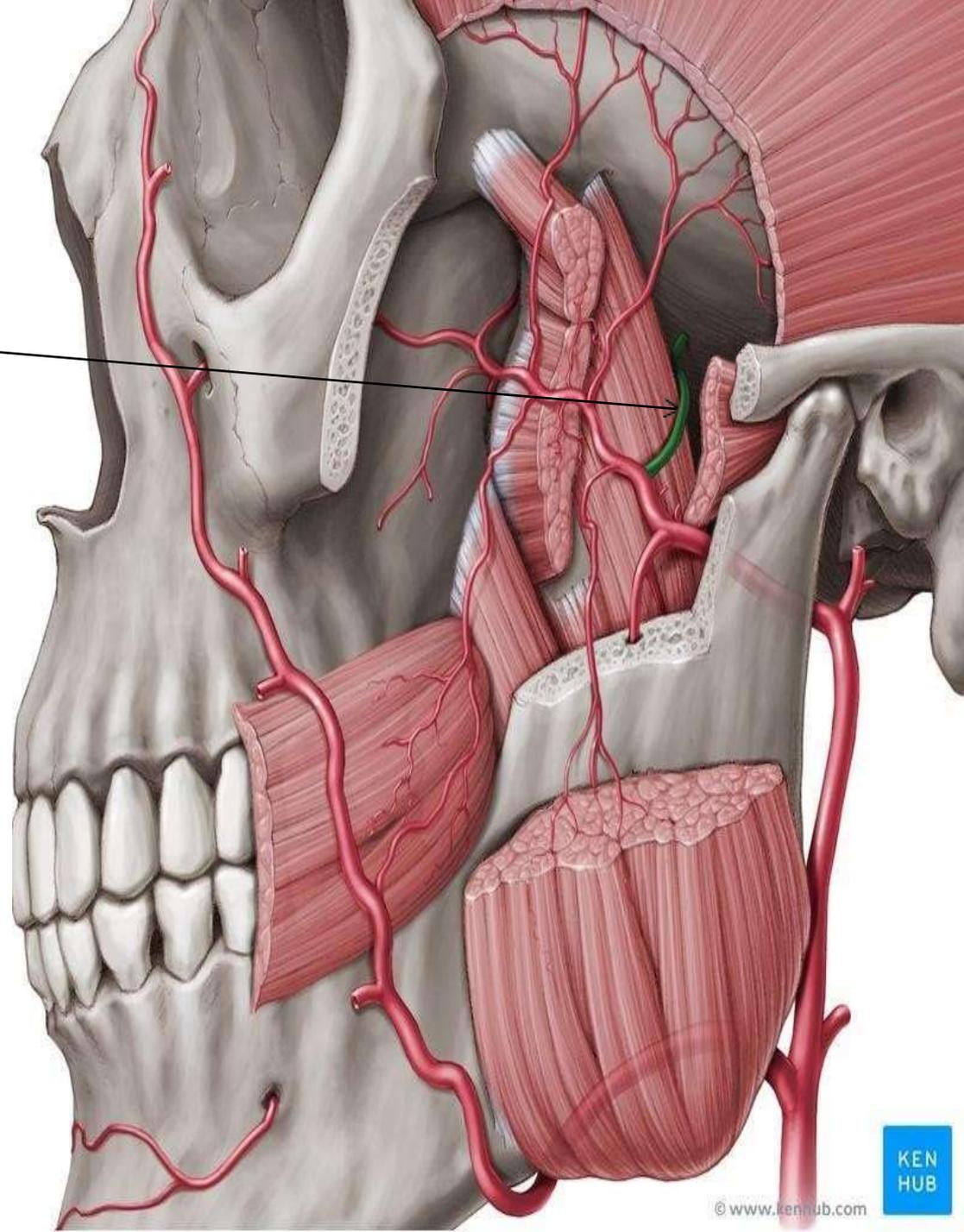
once the internal carotid artery emerging from its canal, it appears as emerging from lacerum >> then directly enter the cavernous sinus and it has a curve with the sinus>> then it emerges from the roof of sinus.

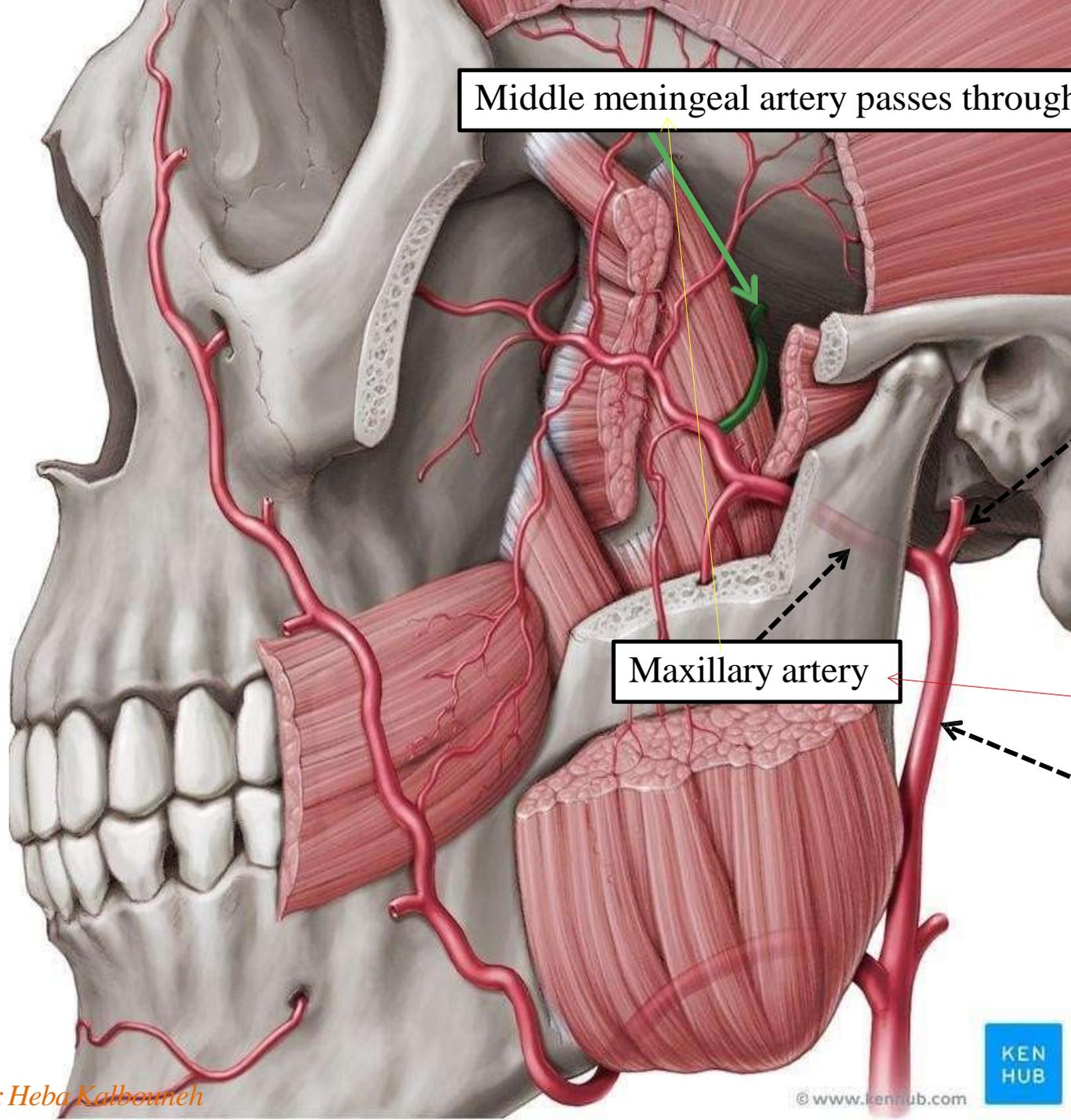


Dural Arterial Supply

Mainly from the **middle meningeal artery**

- Arises from the maxillary artery in the infratemporal fossa it passes through the **foramen spinosum** to lie between the meningeal and periosteal layers of dura





Middle meningeal artery passes through foramen spinosum

Superficial temporal artery

Maxillary artery

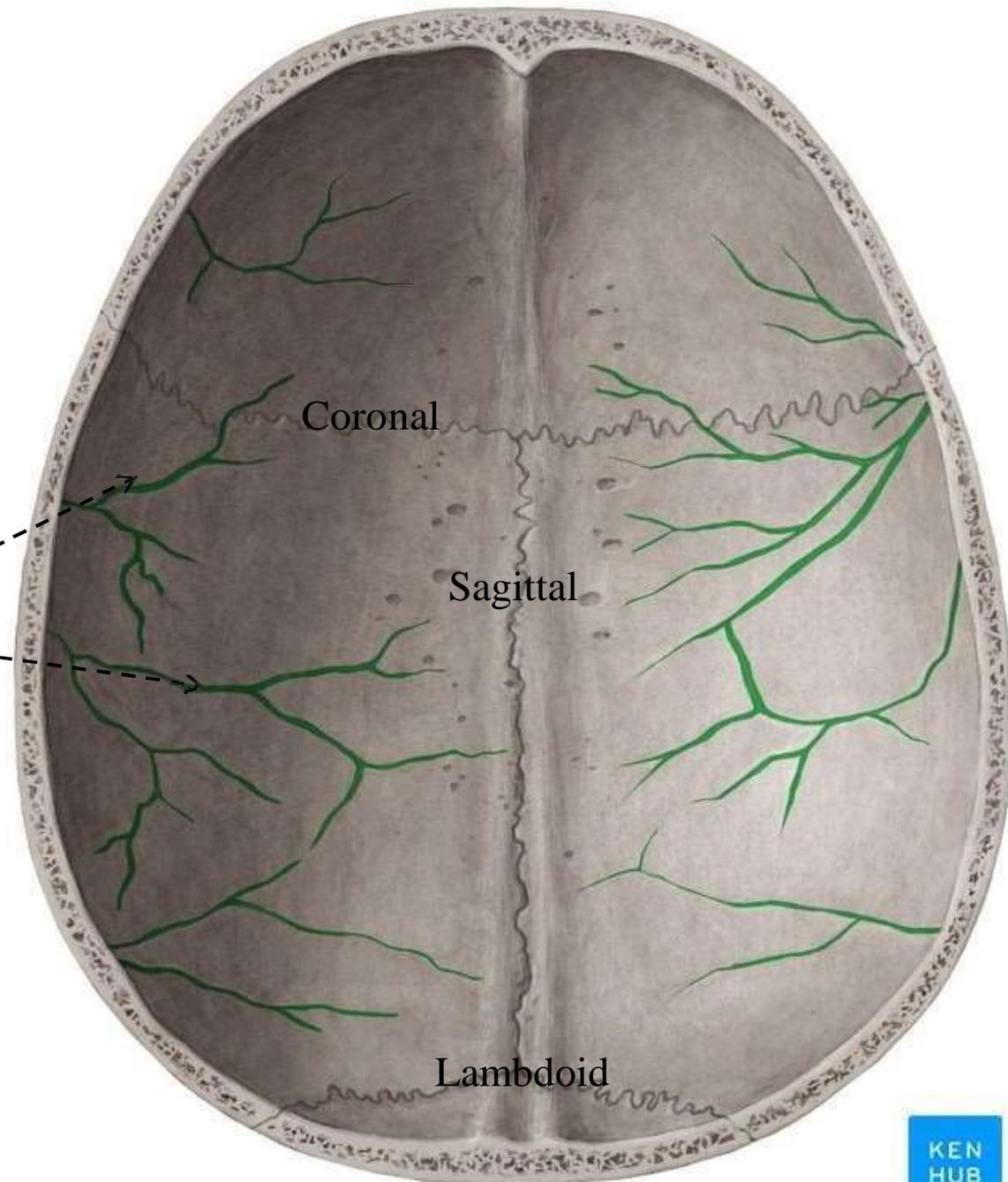
External carotid artery

VAULT OF THE SKULL

Inferior view

The internal surface of the vault presents:

Grooves for the branches of the middle meningeal artery



Middle meningeal artery passes through the foramen spinosum

Branches of Middle Meningeal Artery:

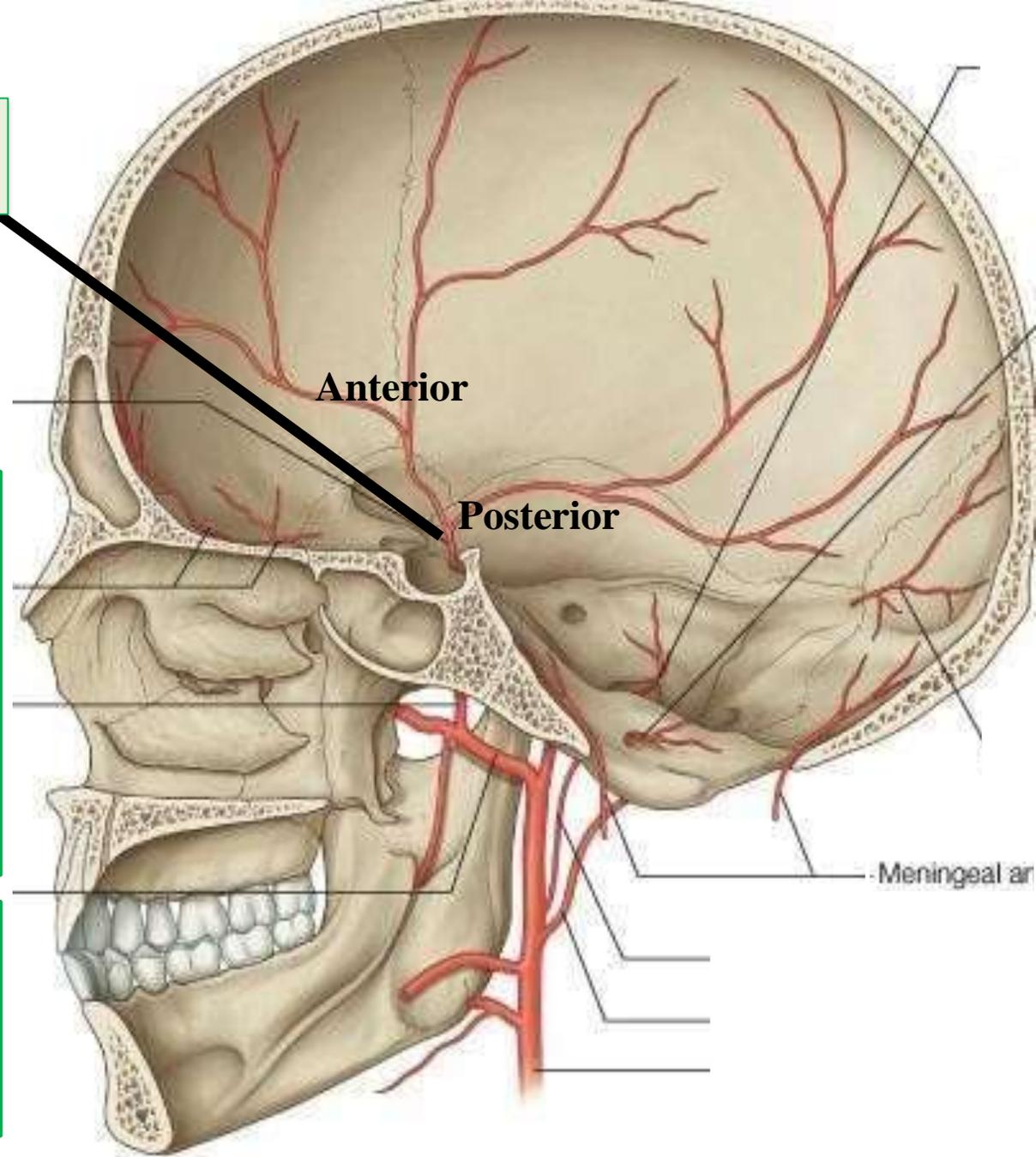
The anterior(frontal)

✓ Passes in an almost vertical direction to reach the vertex of skull

✓ Crosses the pterion during its course

The posterior(parietal)

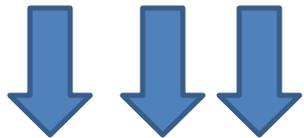
✓ Passes in a posterosuperior direction



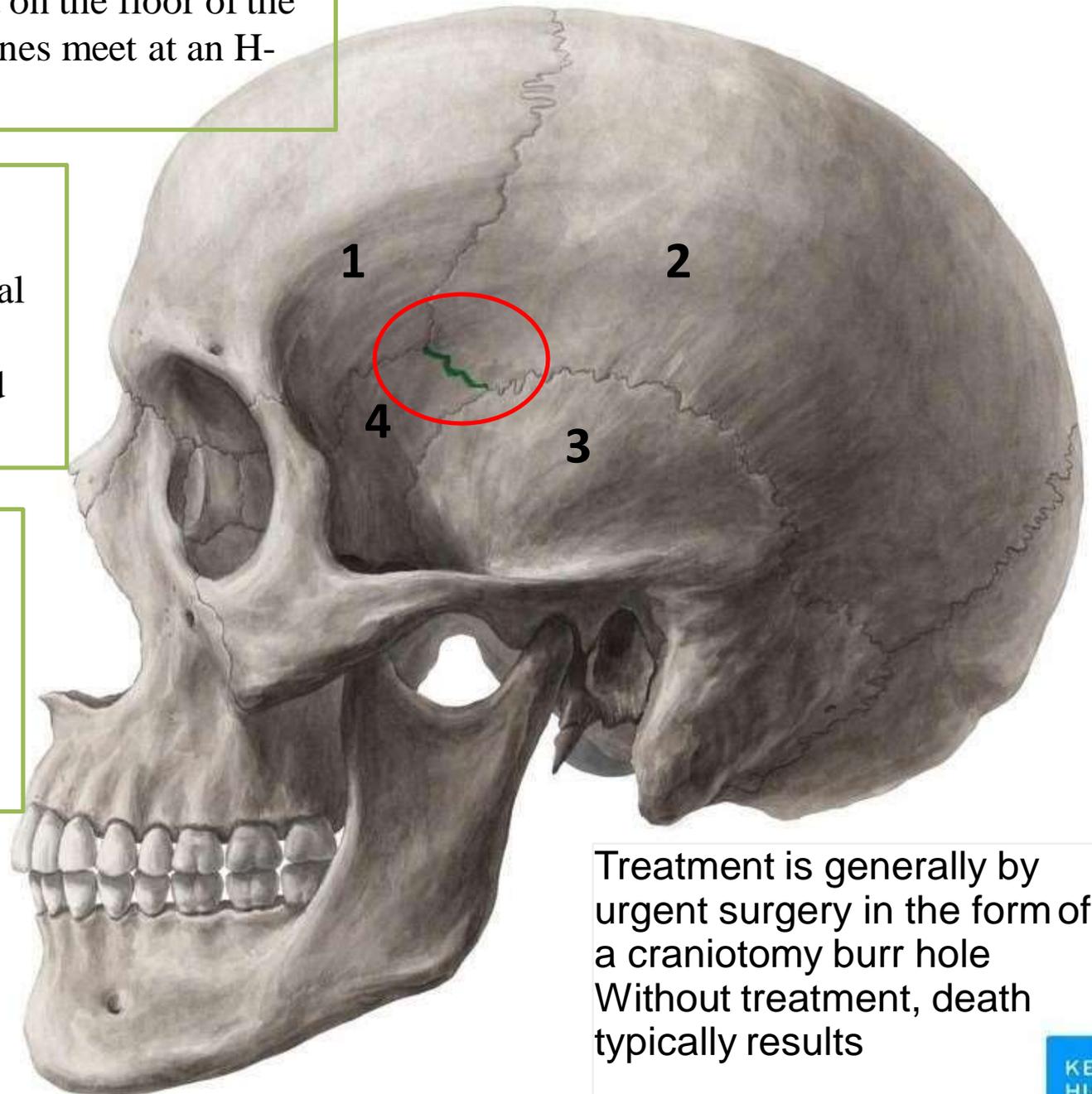
Pterion: is an area located on the floor of the temporal fossa where 4 bones meet at an H-shaped structure

- 1 Frontal
- 2 Parietal
- 3 Squamous part of temporal bone
- 4 Greater wing of sphenoid

The pterion is the thinnest part of the lateral wall of the skull. It overlies the anterior division of The middle meningeal artery and vein



Epidural bleeding

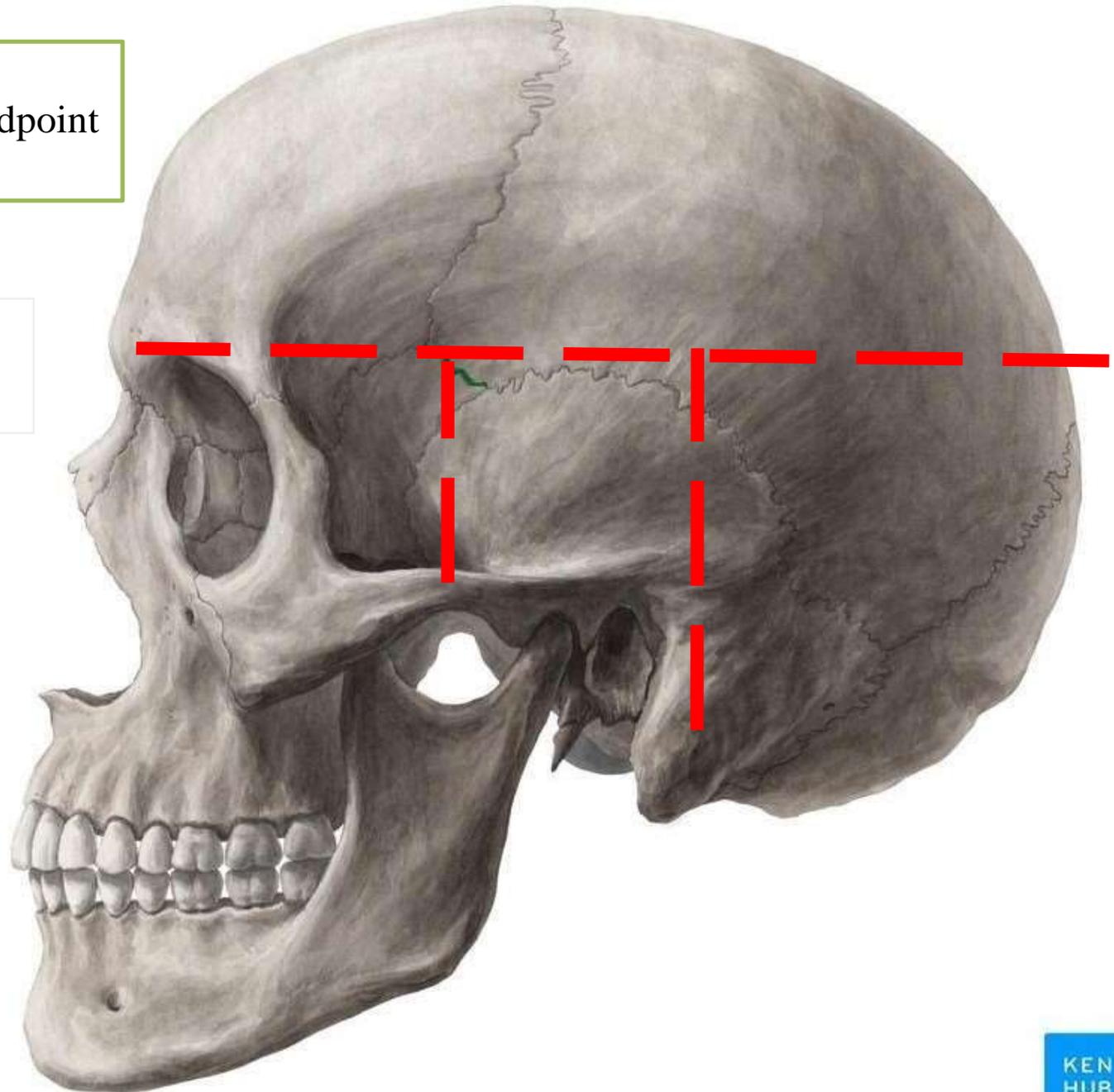


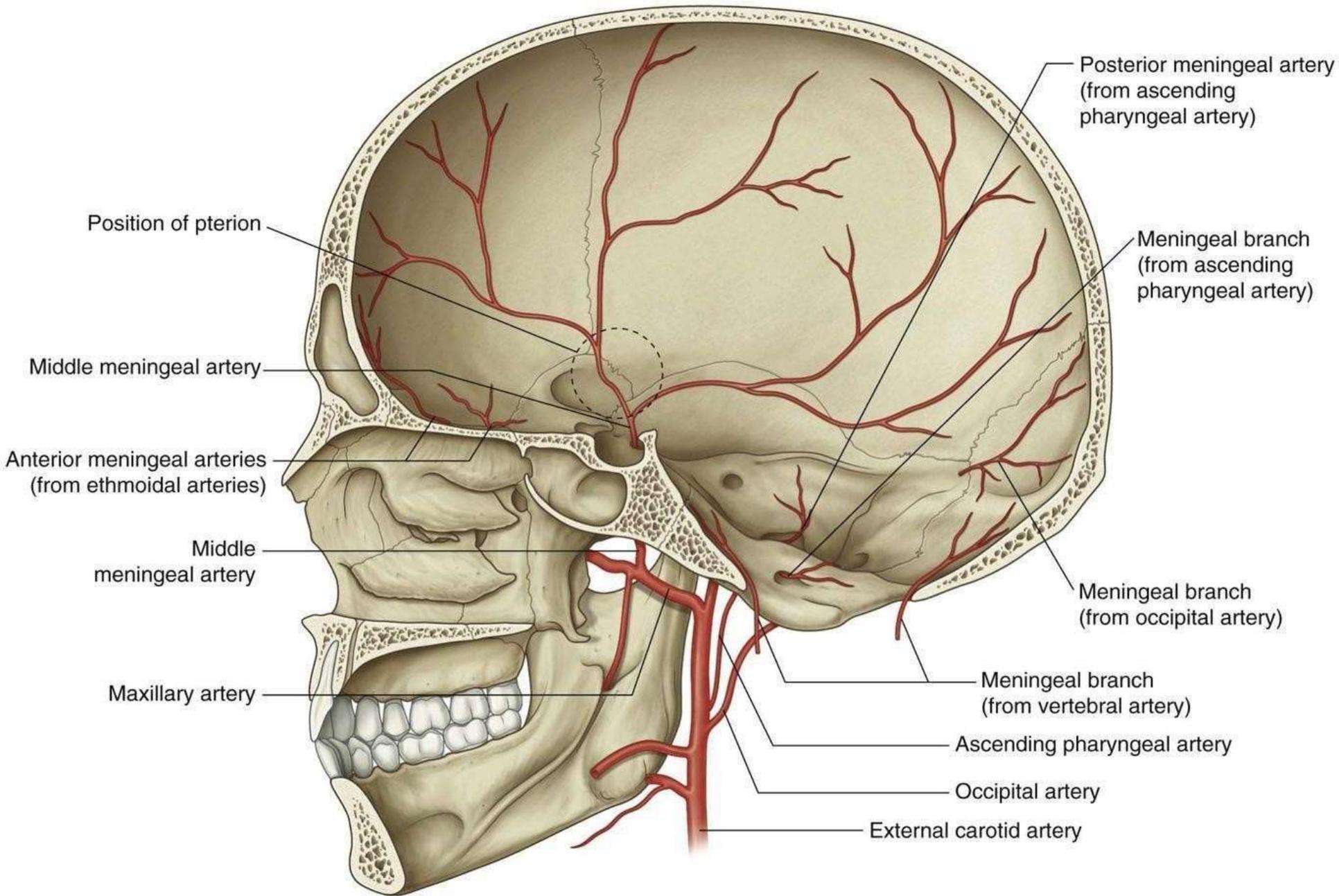
Treatment is generally by urgent surgery in the form of a craniotomy burr hole
Without treatment, death typically results

Pterion surface marking

(2.5 to 4 cm) above the midpoint of the zygomatic arch

>>in order to evacuate the blood, in case of Epidural bleeding. :(





Dural Nerve Supply

Branches of the trigeminal, vagus, and upper cervical nerves

it has many sensory receptors

The dura is sensitive to stretching, which produces the sensation of headache.

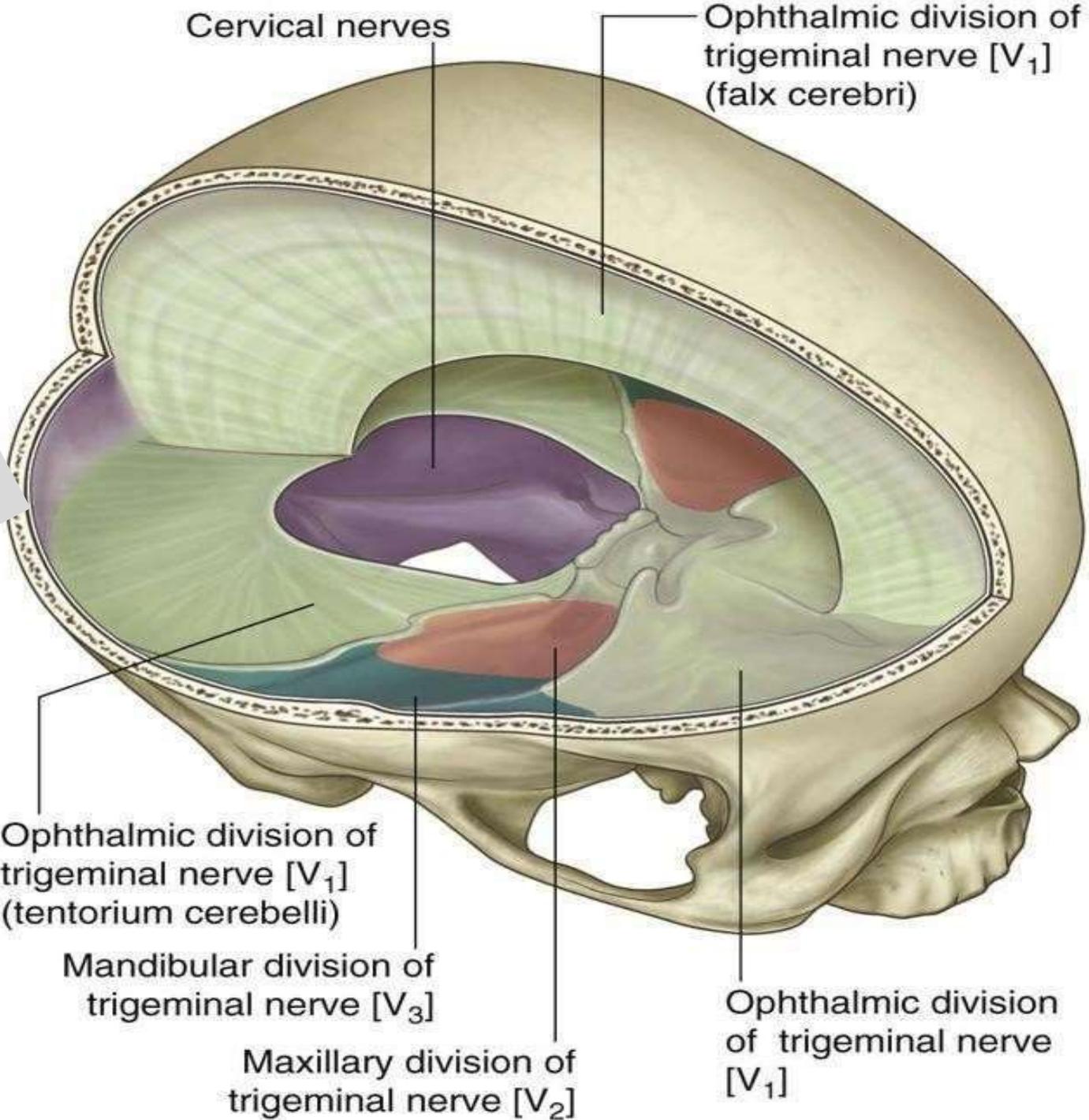
Stimulation of the sensory endings of the trigeminal nerve above the level of the tentorium cerebelli produces **referred pain to an area of skin on the same side of the head (trigeminal distribution)**.

Stimulation of the dural endings below the level of the tentorium cerebelli (posterior cranial fossa) produces **referred pain to the back of the neck and back of the scalp along the distribution of the greater occipital nerve**

Meningitis and stiff neck

Remember
Referred pain refers to the phenomenon of feeling pain in a region that is not actually the source of the pain

you should know :
the brain isn't a sensitive structure => if you have a problem inside the brain you will not feel the pain , except if the covering dura is be affected > here you can feel the pain



Supratentorial cerebelli >> by trigeminal nerve

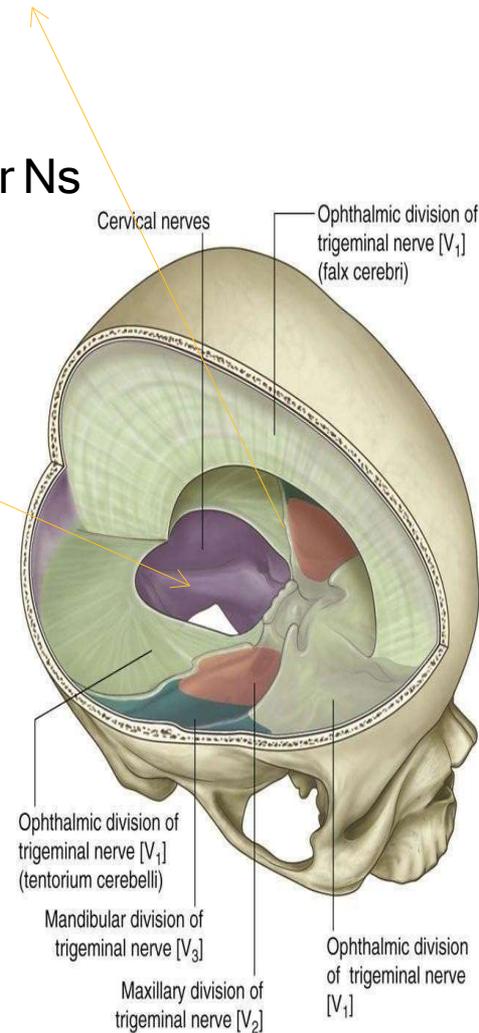
- falx cerebri => ophthalmic N
- superior surface of tentorium cerebelli => ophthalmic N
- dura covering the anterior cranial fossa => ophthalmic N
- dura covering the middle cranial fossa => maxillary & mandibular Ns

Infratentorial cerebelli >> by dorsal rami of upper three cervical Ns

- falx cerebelli.
- dura covering the posterior cranial fossa.
- inferior surface of tentorium cerebelli.

Referred pain, our CNS doesn't discriminate from where this message comes exactly from.

So in case of headache, it doesn't discriminate if the pain is from face or dura or back of the orbit.



- one of the theories to explain the primary Headache (has no cause(90% of the headache)) “dilation of blood vessels of dura >> irritation of the dura >>stimulation of the sensory receptors of the Dura affected by the stretch irritation of the dura itself.“

>>so when you have a headache, you have referred pain in the area of distribution of the trigeminal Ns (mainly ophthalmicN)

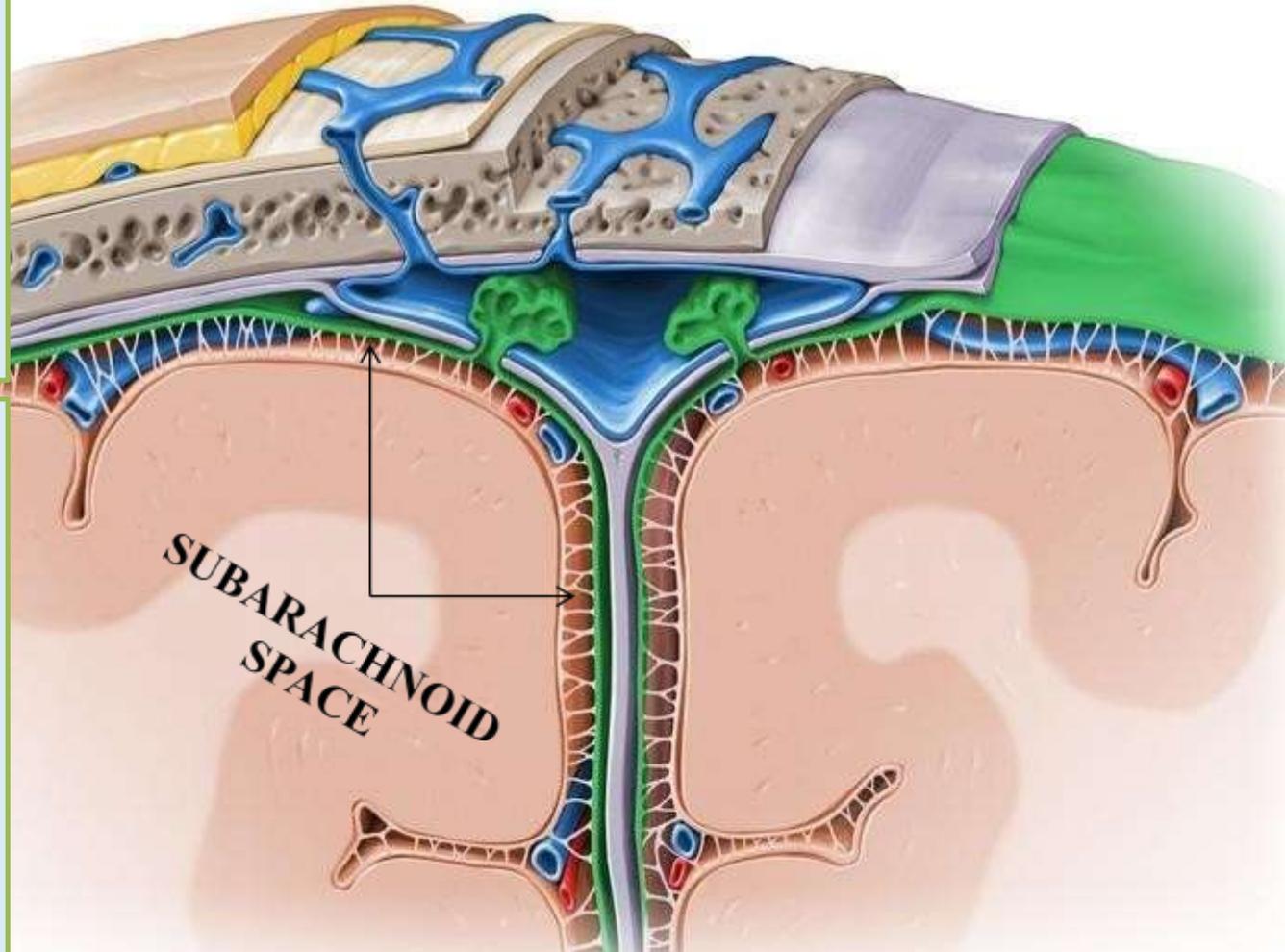
- meningitis>> infection of meninges
- the most important symptom (first symptom): severe headache due to irritation of the dura>> transmitted as headache sensation
- other symptom: stiffness of the neck (you can't do flexion to the neck)

Because the dorsal rami of the upper three cranial nerves also Supply the skin and underlying vertebral muscles , in addition to Infratentorial cerebelli >> will cause paralysis in these muscles.

Arachnoid Mater of the Brain

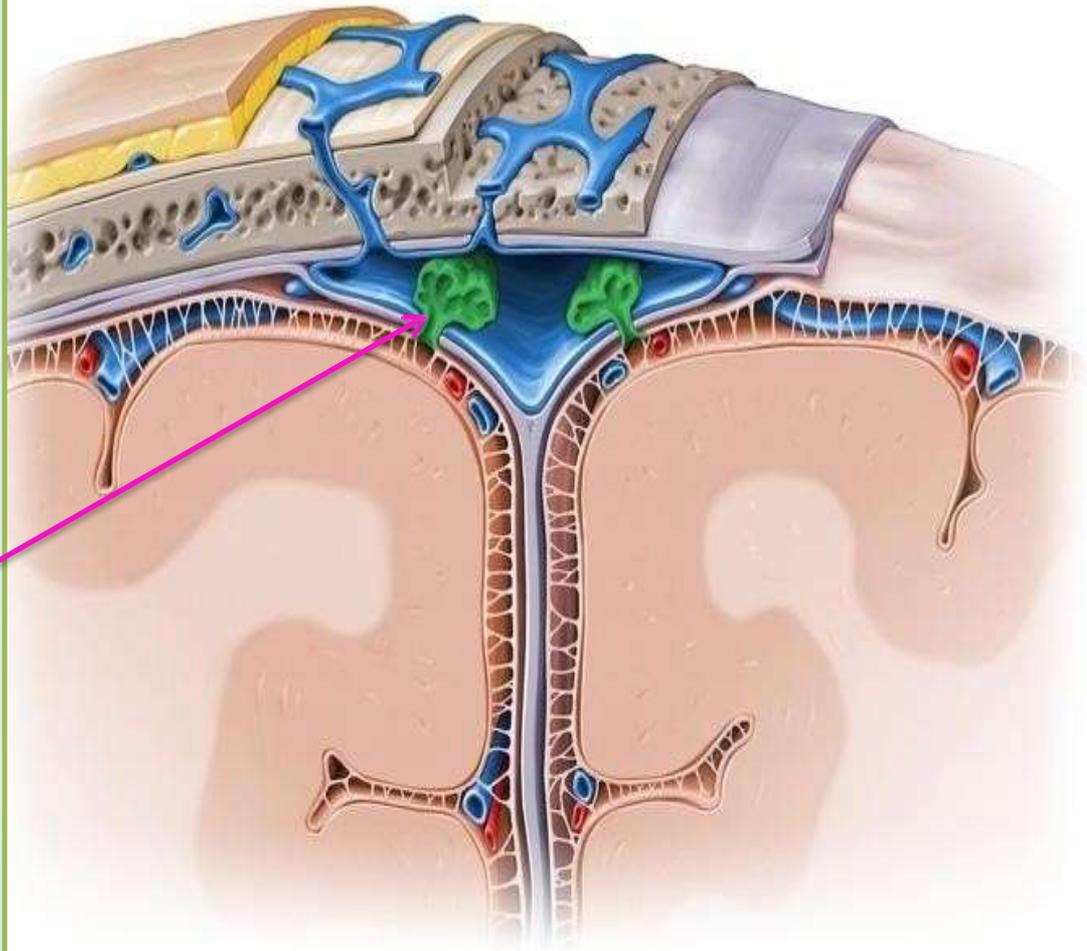
➤ The arachnoid mater is a delicate membrane covering the brain and lying between **THE PIAMATER INTERNALLY** and **THE DURAMATER EXTERNALLY**

It is separated from the dura by a potential space **THE SUBDURAL SPACE** and from the pia by **THE SUBARACHNOID SPACE** which is filled with **cerebrospinal fluid**



Arachnoid Mater of the Brain

- In certain areas the arachnoid projects into the venous sinuses to form arachnoid villi.
- The arachnoid villi are most numerous along the superior sagittal sinus
- Aggregations of arachnoid villi are referred to as **arachnoid granulations**
- Arachnoid villi serve as sites where the cerebrospinal fluid diffuses into the bloodstream

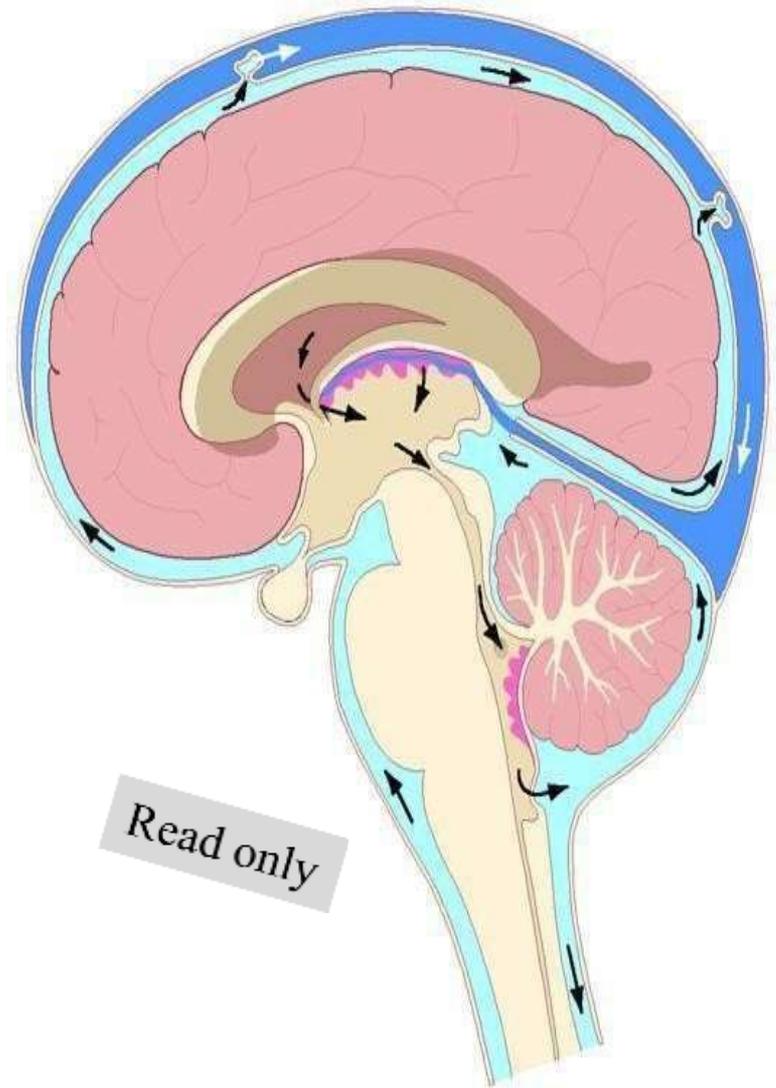


➤ The cerebrospinal fluid (CSF) is produced within the ventricles of the brain.

➤ It escapes from the ventricular system of the brain through the three foramina and so enters the subarachnoid space

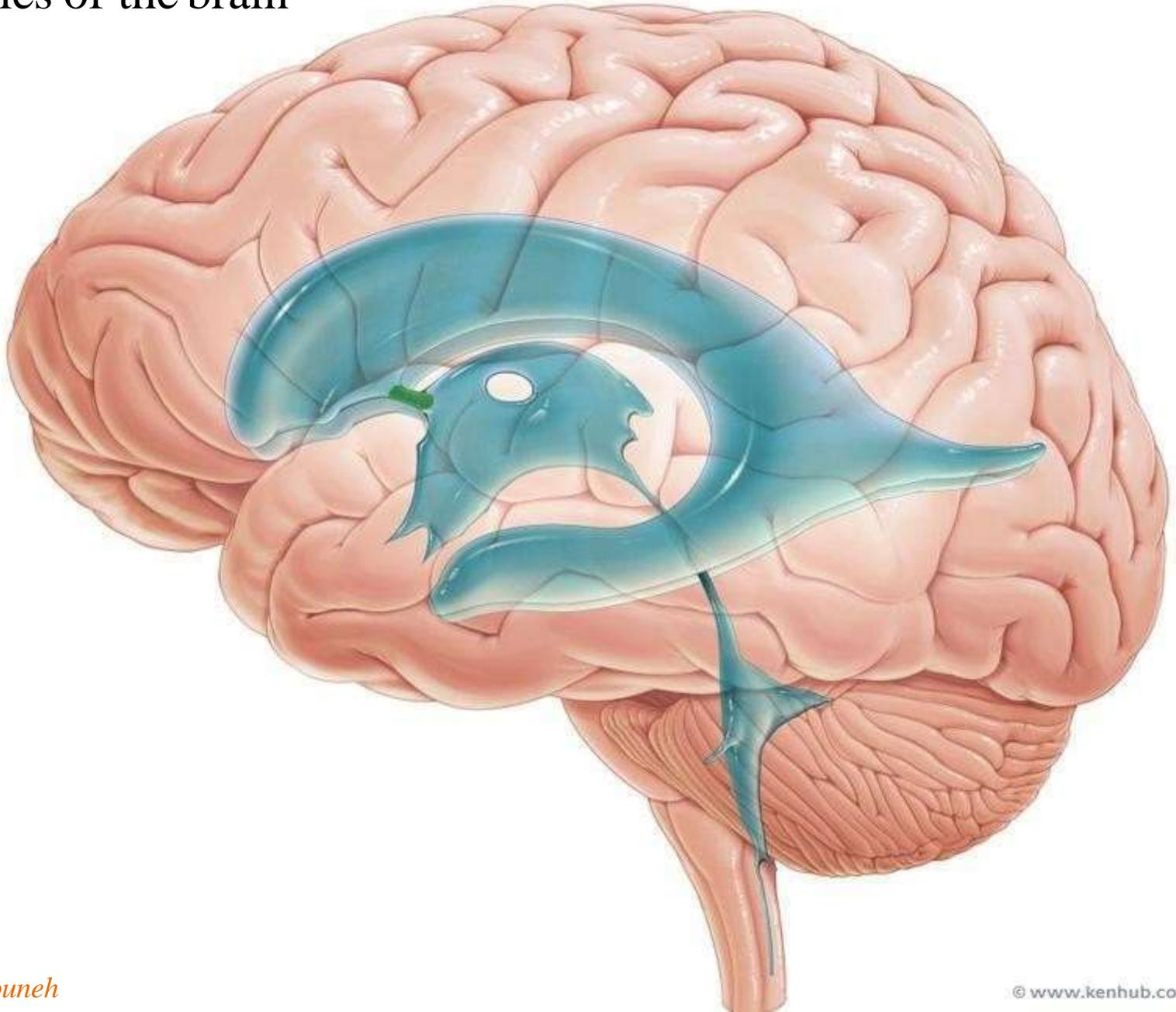
➤ It now circulates both upward over the surfaces of the cerebral hemispheres and downward around the spinal cord

➤ Eventually, the fluid enters the bloodstream by passing into the arachnoid villi and diffusing through their walls



The spinal subarachnoid space extends down as far as the second sacral vertebra

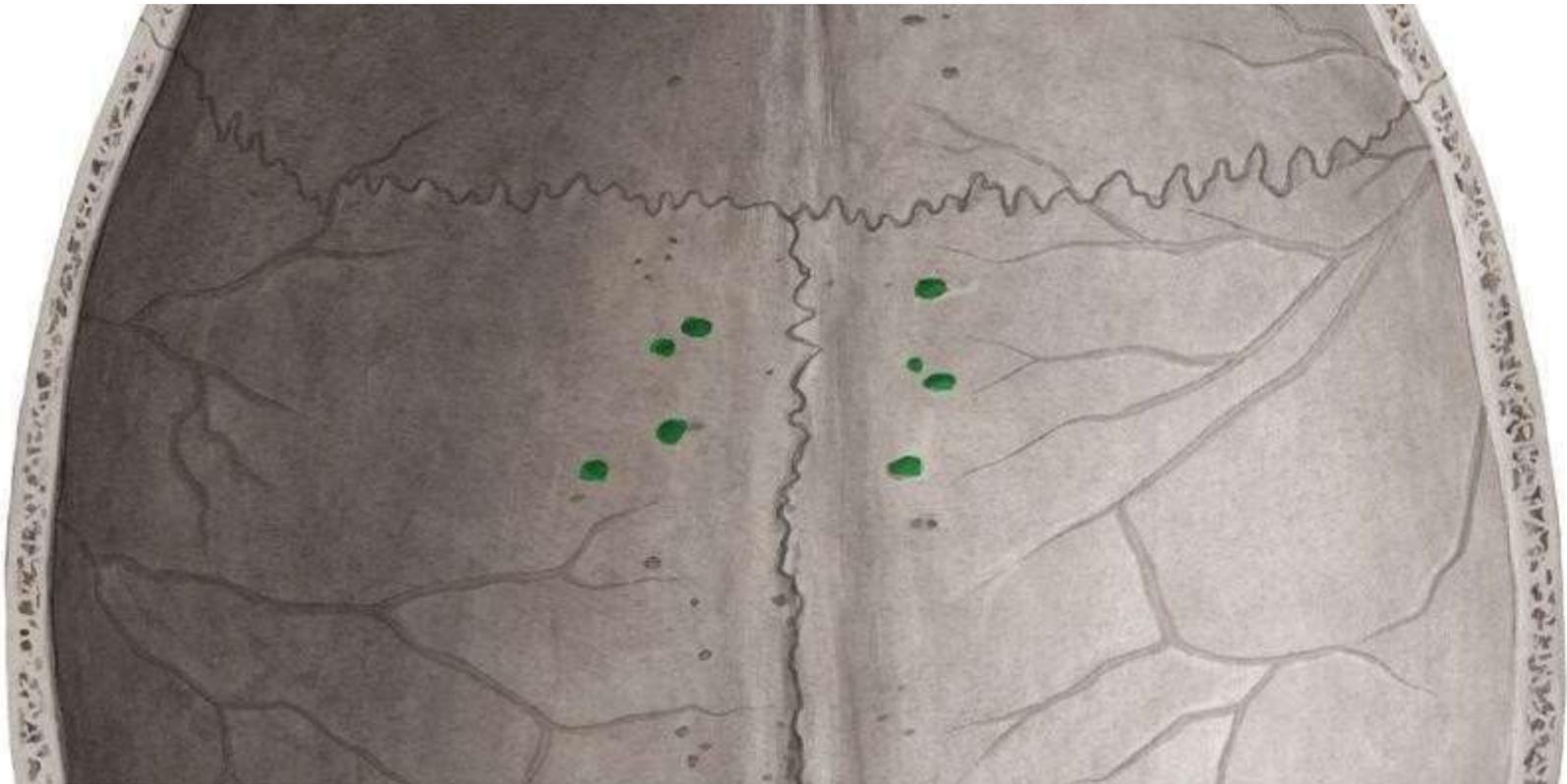
Ventricles of the brain



On each side of the superior sagittal groove are several small pits, called

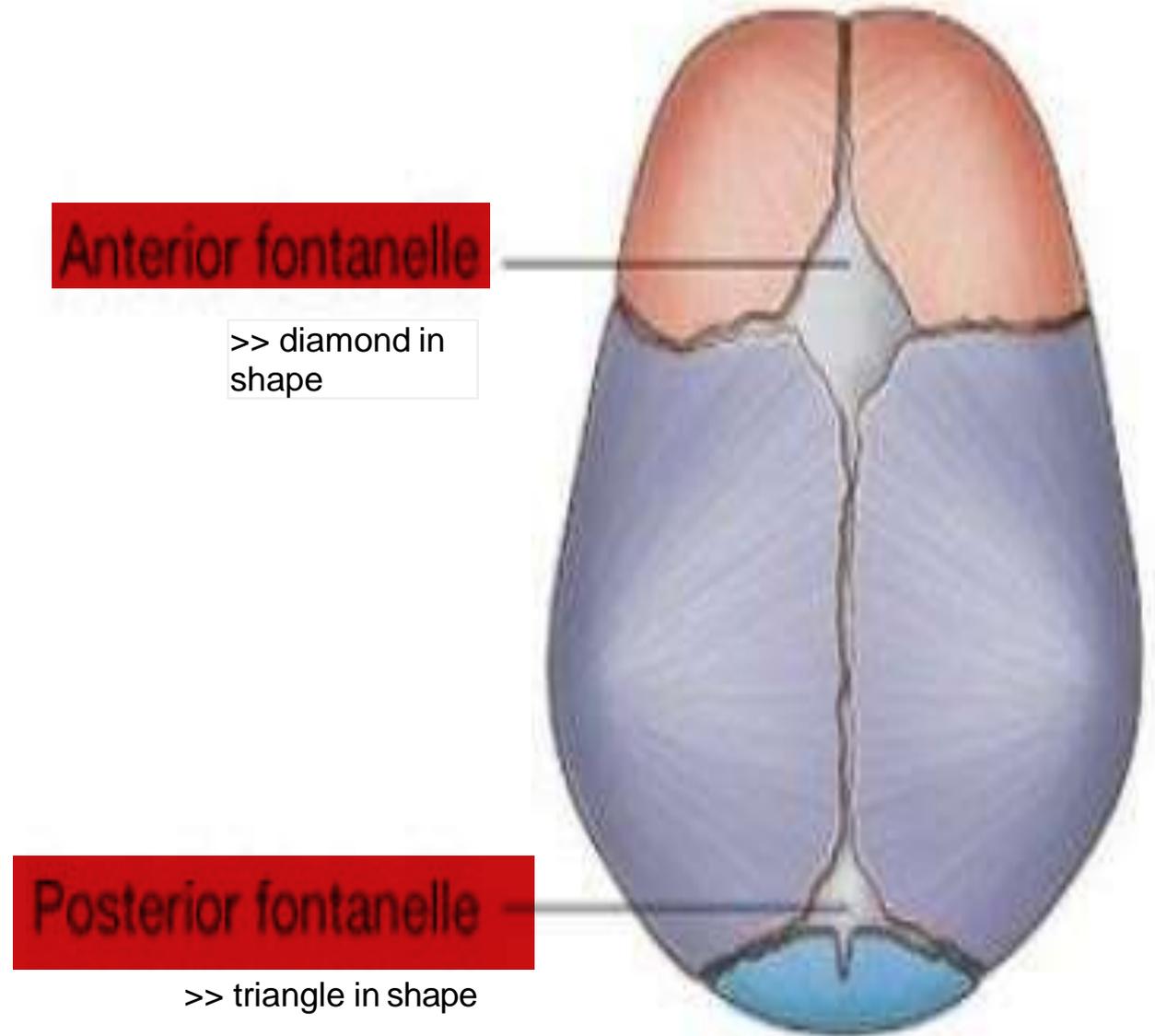
GRANULAR PITS (Foveolae)

GRANULAR PITS are indentation of the skull formed by arachnoid granulations



Neonatal Skull

- **Fontanelles:** unossified membranous intervals
- **Anterior fontanelle:** (diamond) closed by 18 months
- **Posterior fontanelle:** (triangular) closed by 12 months
- **Important clinically, why?**



Clinical Features of the Neonatal Skull

FONTANELLES

Palpation of the fontanelles enables the physician to determine

1-The progress of growth in the surrounding bones

2-the degree of hydration of the baby

For example

if the fontanelles are depressed below the surface

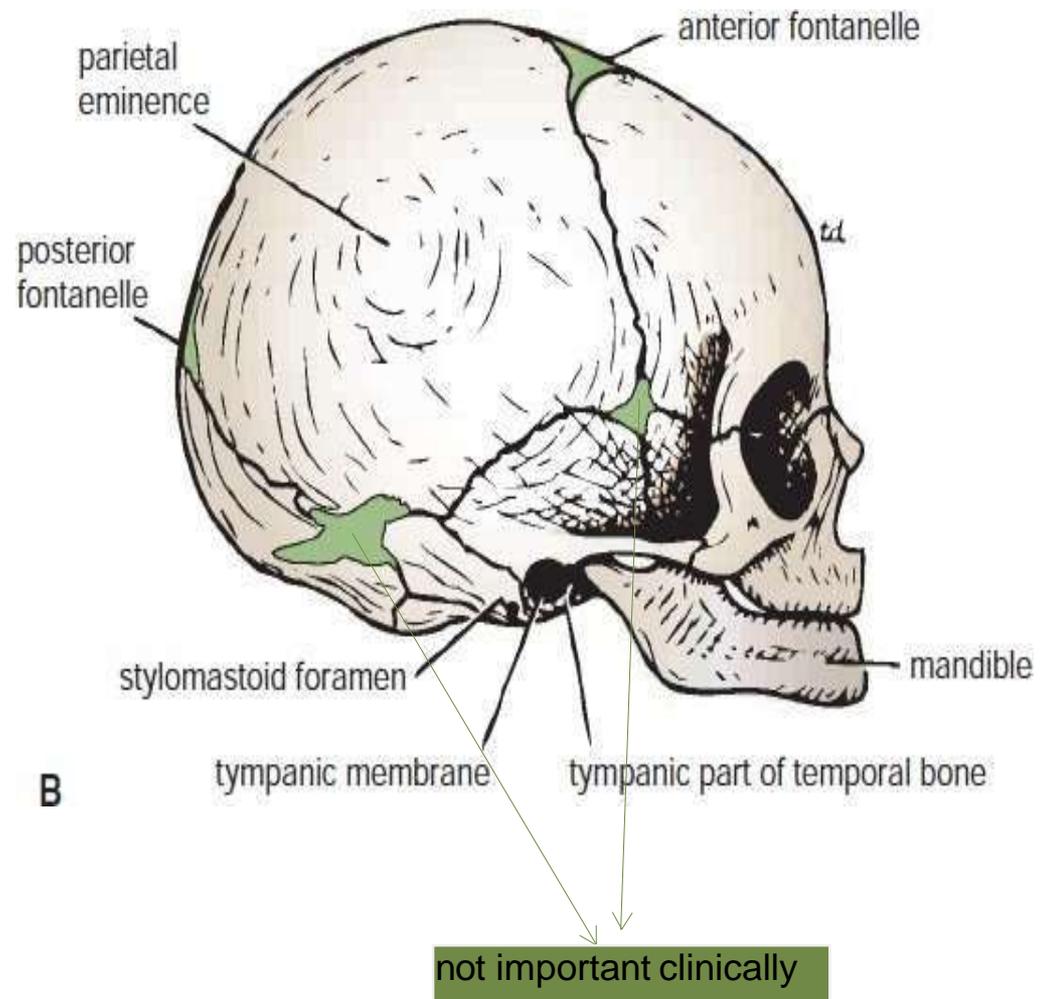


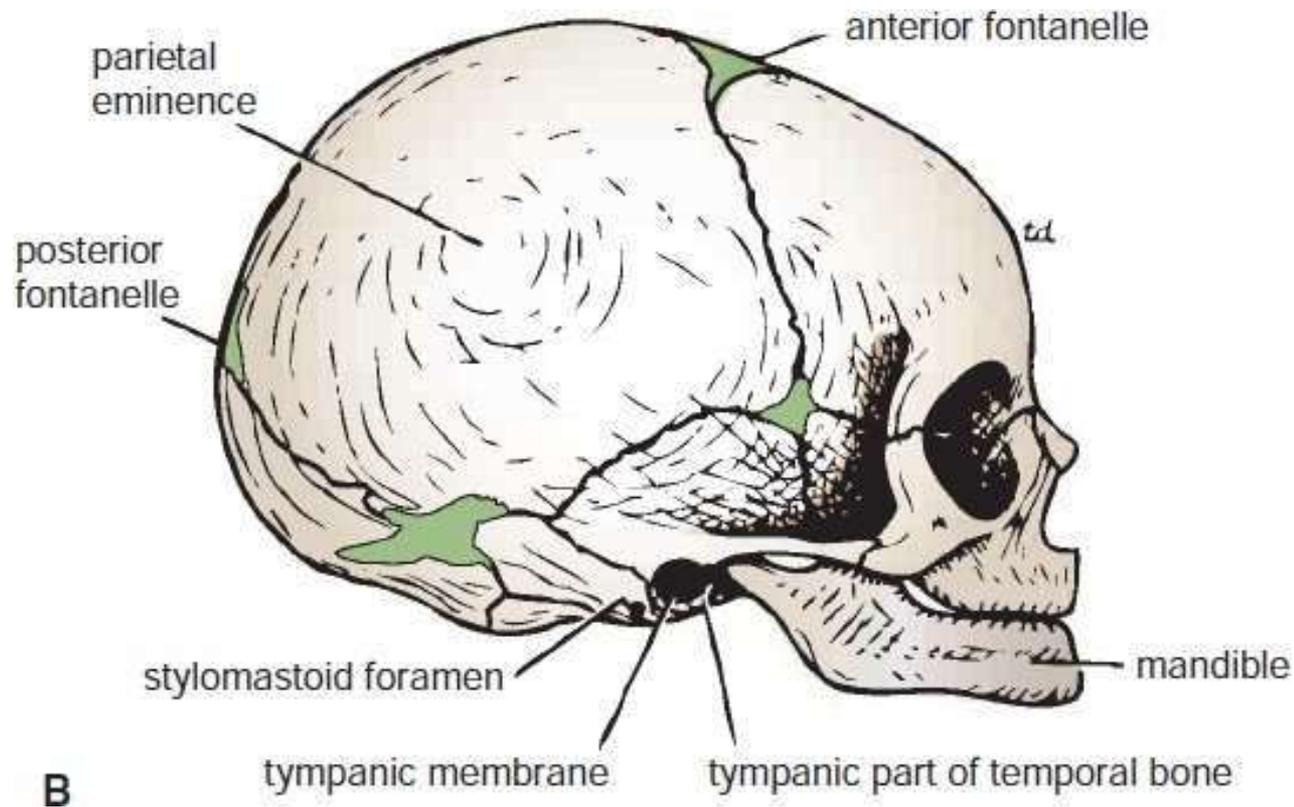
THE BABY IS DEHYDRATED

A bulging fontanelle indicates



RAISED INTRACRANIAL PRESSURE



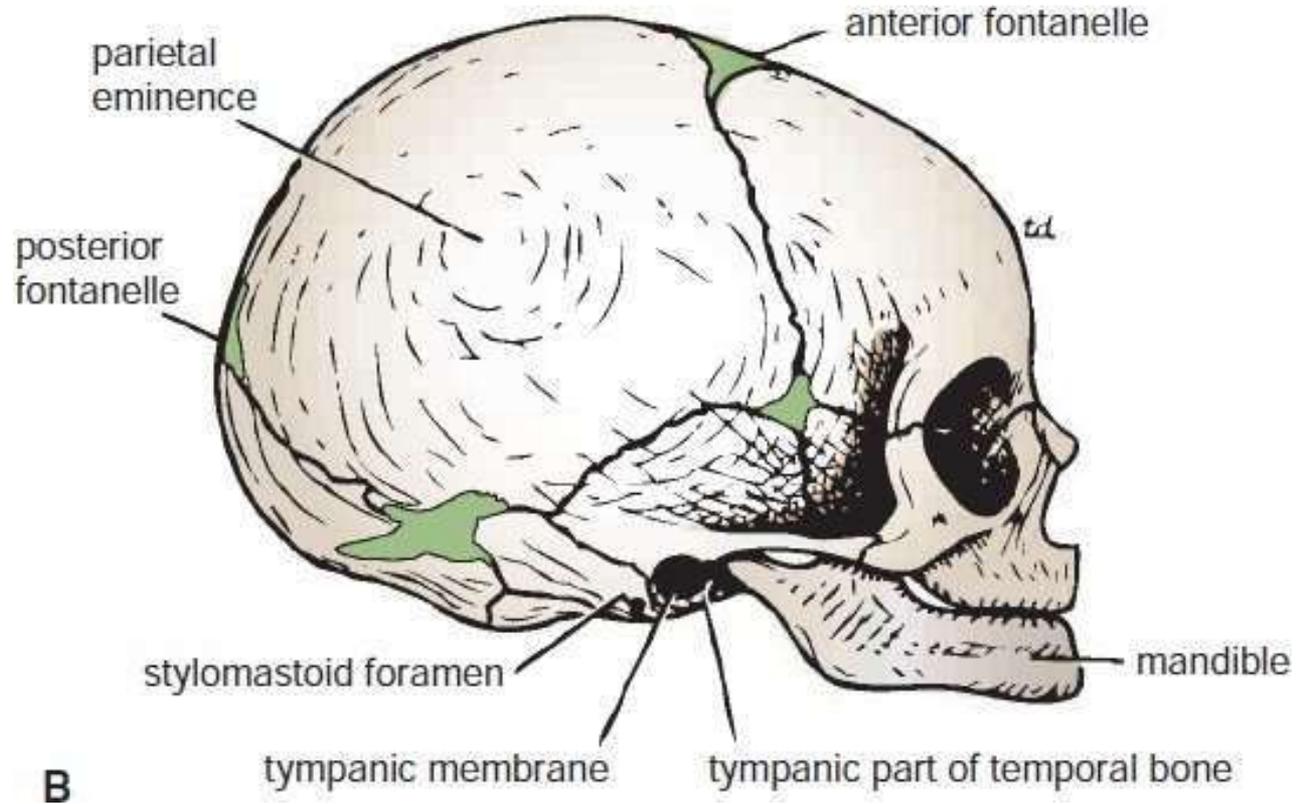


Clinical note: Samples of cerebrospinal fluid can be obtained by passing a long needle obliquely through the anterior fontanelle into the subarachnoid space

=> to see if there is an infection in meninges or a bleeding in subarachnoid space

Neonatal Skull

- Large cranium relative to the face
- No mastoid process
- Angle of the mandible is obtuse



Clinical note:

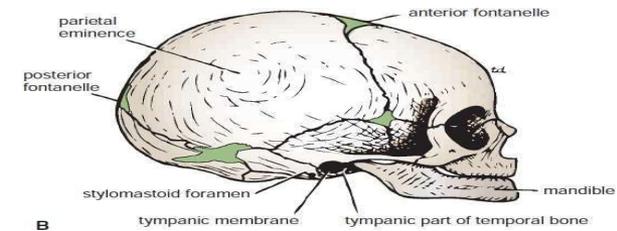
Facial nerve can be damaged by forceps in a difficult delivery. **Why?**

In the newborn infant, the mastoid process is not developed, and the facial nerve, as it emerges from the stylomastoid foramen, is close to the surface. Thus, it can be damaged by forceps in a difficult delivery.

- Certain bones of the skull, they are spaces filled with air (paranasal sinuses): maxillary sinuses, frontal sinuses, ethmoid sinuses & sphenoid sinuses, they are communicated with the nasal cavity (that's why they are filled with air) >>IN ORDER TO reduce the weight of the skull & they help in produce the sound.

⇒That's why when we have sinusitis (infection in the nasal sinuses)

- Our heads become heavier>> these space are become filled with a fluid instead of air due to the infection. ^^
- Our sounds will be changed. ^^



NOW!!

Why neonatal skull has large cranium relative to the face??

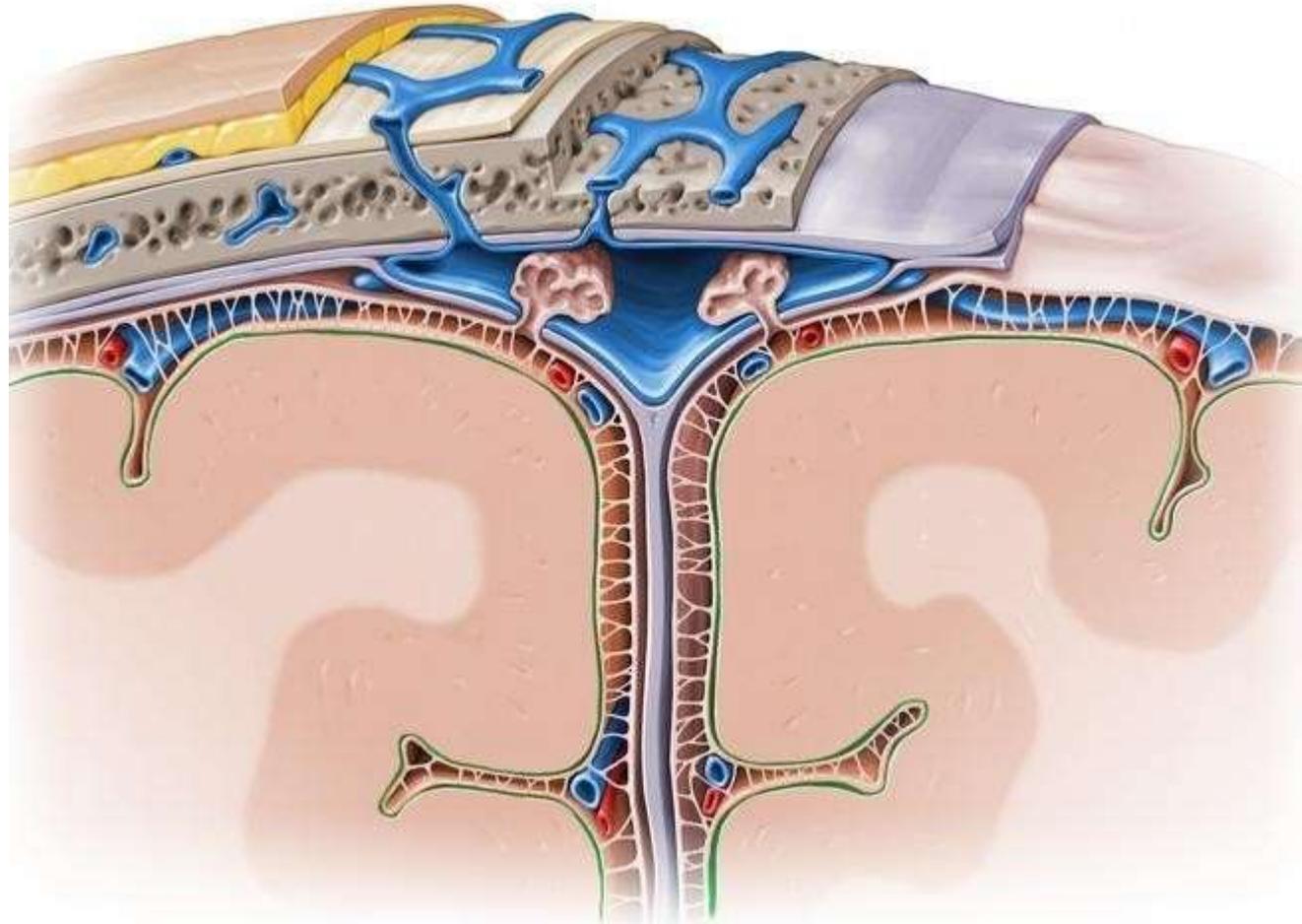
1) Directly after birth, these sinuses^ aren't developed yet, as we age they will begin growing to form spaces & bigger facial bones >> Enlargement the face.

2) Teeth haven't erupted yet.

>> eruption the teeth make the maxilla & mandibular bigger.

Pia Mater

=> soft



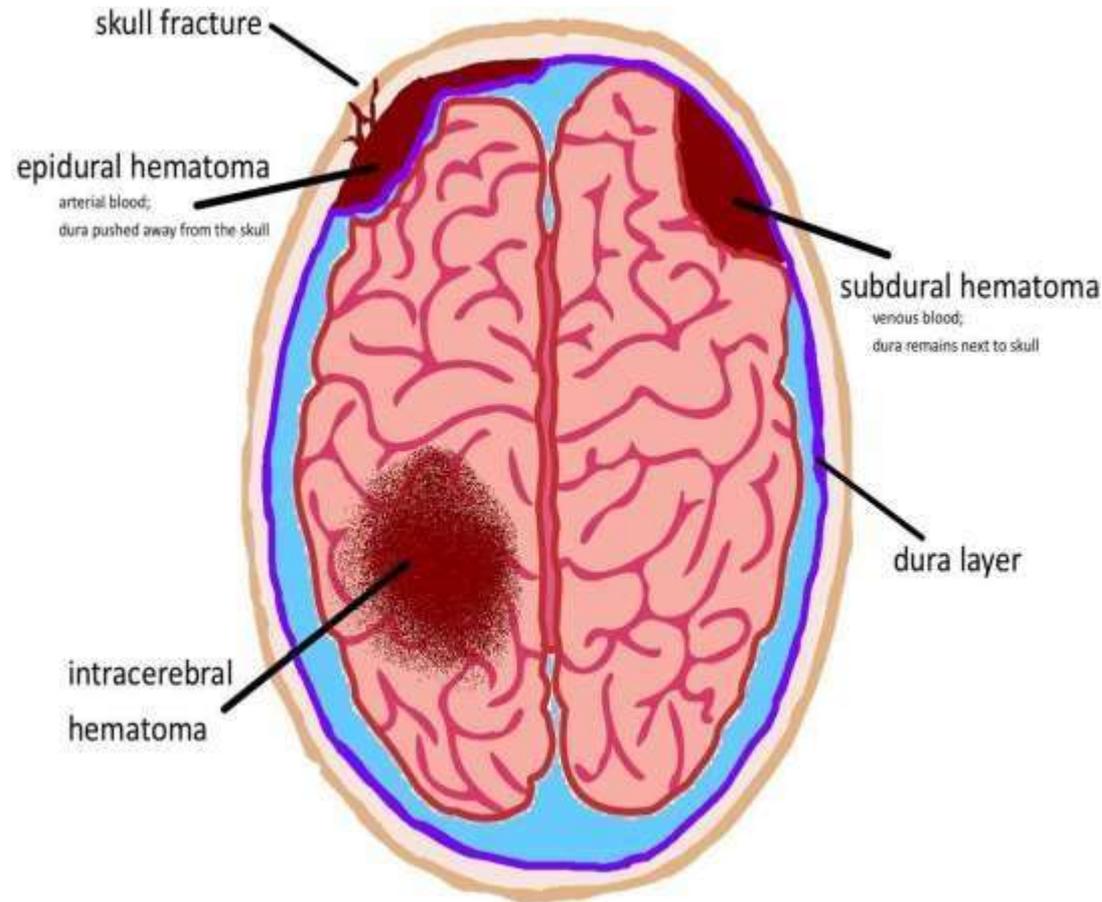
Intracranial Hemorrhage

Epidural hemorrhage

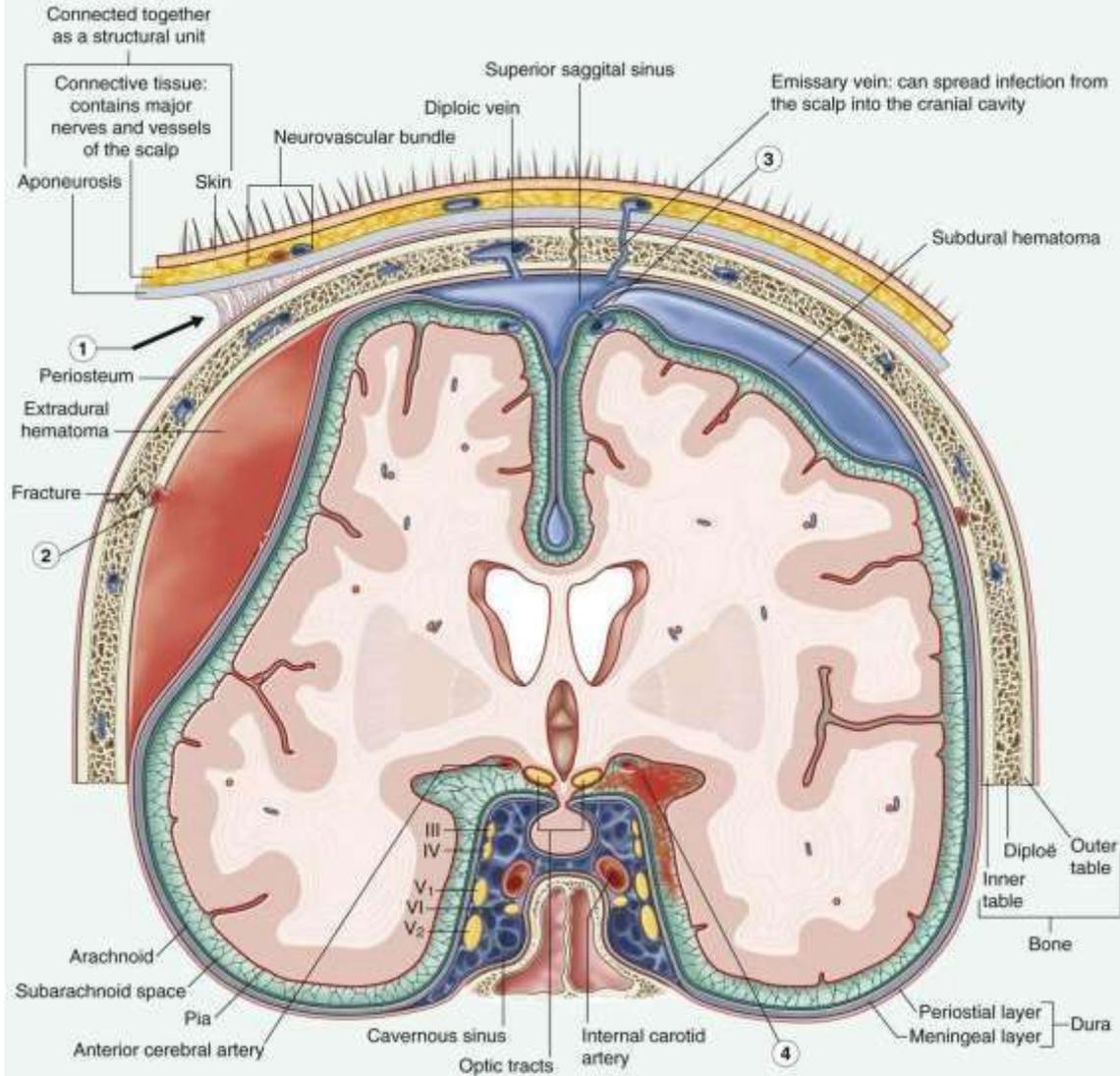
Subdural hemorrhage

Subarachnoid hemorrhage

Intracerebral hemorrhage



each one has different location & causes, clinical consequence



Read only

1 Loose connective tissue (danger area)

- In scalping injuries, this is the layer in which separation occurs.
- Infection can easily spread in this layer.
- Blunt trauma can result in hemorrhage in this layer (blood can spread forward into the face, resulting in "black eyes").

2 Rupture of the middle meningeal artery (branches) by fracture of the inner table of bone results in extradural hematoma. Under pressure, the blood progressively separates dura from the bone.

3 Tear to cerebral vein where it crosses dura to enter cranial venous sinus can result in subdural hematoma. The tear separates a thin layer of meningeal dura from that which remains attached to the periosteal layer. As a result, the hematoma is covered by an inner limiting membrane derived from part of the meningeal dura.

4 Aneurysm

- Ruptured aneurysms of vessels of the cerebral arterial circle hemorrhage directly into the subarachnoid space and CSF.

Extradural hemorrhage/ epidural

ARTERIAL

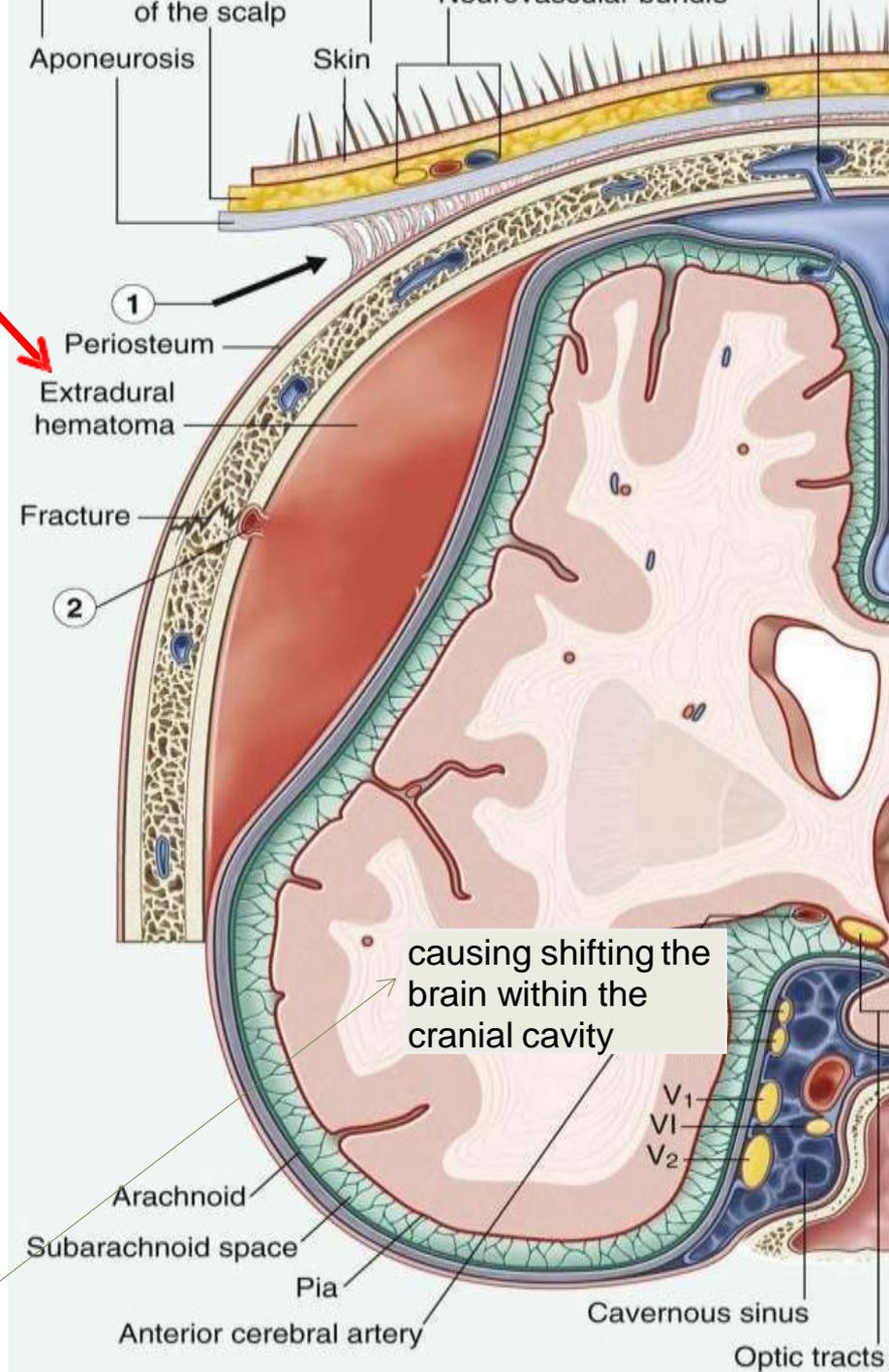
The most common artery to be damaged is the anterior division of the **middle meningeal artery**

Results from a blow to the side of the head, resulting in fracture of the skull in the region of **Pterion**

Bleeding occurs and strips up the meningeal layer of dura from the periosteal layer (lining of skull bone)

The intracranial pressure rises, and the enlarging blood clot exerts local pressure on the underlying motor area

this type of bleeding is limited at suture site, because the dura continues with suture >> biconvex shape <<
Main symptom > headache >> due to irritation of the dura



Lucid interval

- Lucid interval is a temporary improvement in a patient's condition after a traumatic brain injury, after which the condition deteriorates
- It occurs after the patient is knocked out by the initial concussive force of the trauma, then lapses into unconsciousness again after recovery when bleeding causes the hematoma to expand past the point at which the body can no longer compensate

A lucid interval is especially indicative of an epidural hematoma.

An estimated 20 to 50% of patients with epidural hematoma experience such a lucid interval.

It can last minutes or hours

lucid interval (no symptoms) for
a few hours followed by
death
("talk and die syndrome")

To stop the hemorrhage, the torn artery or vein must be ligated or plugged. The burr hole through the skull wall should be placed about 1 to 1.5 in. (2.5 to 4 cm) above the midpoint of the zygomatic arch.

in the brain there is a motor area to control the muscles of the contralateral side of the body > so compression in this area cause paralysis in this side

تعمل شلل نصفي اذا عاش المريض

Read only

emergency!!
blood should be evacuated before be clotted.

Subdural hemorrhage

VENOUS

Results from tearing of the cerebral veins at their point of entrance into the superior sagittal sinus (**bridging veins**)

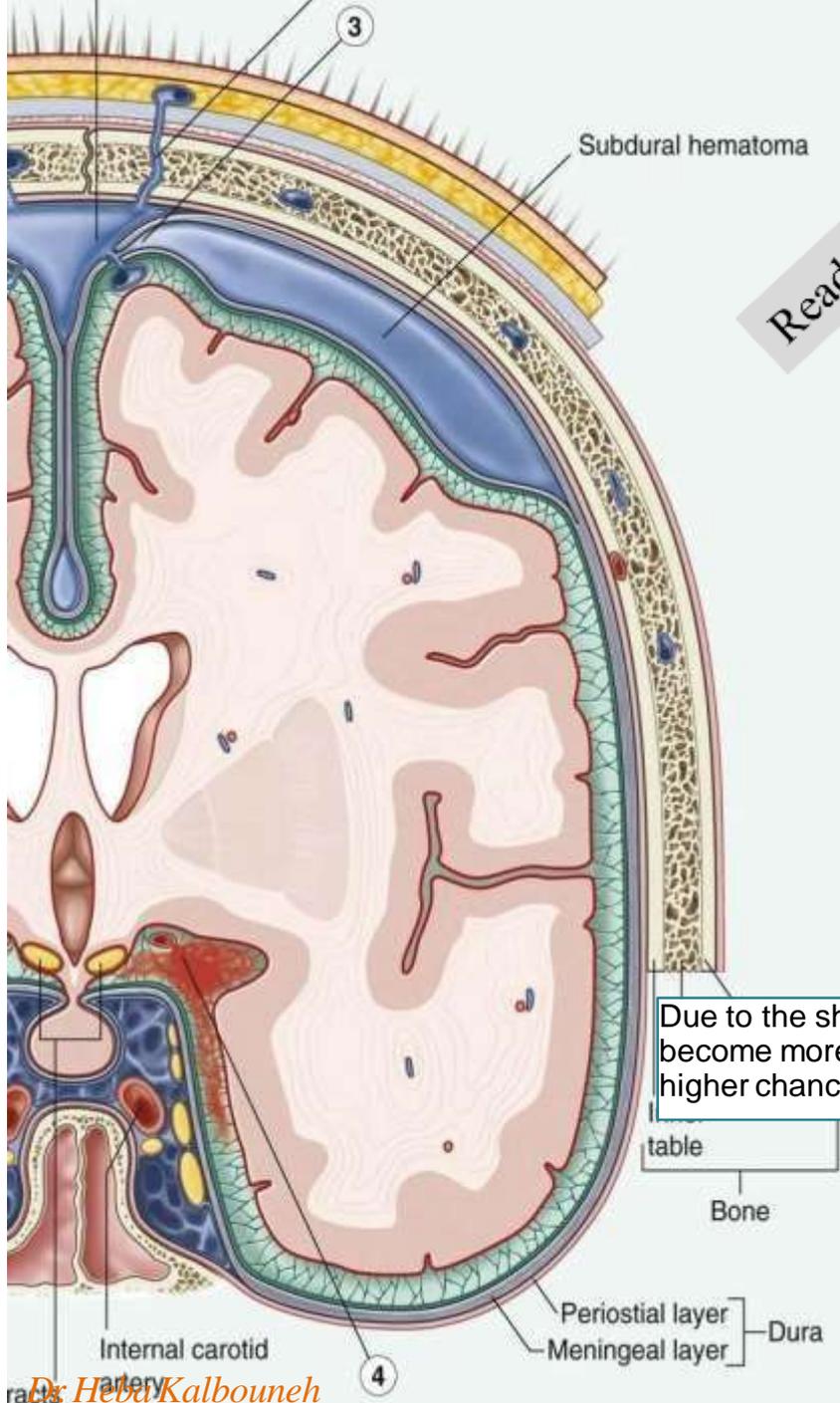
The cause is usually excessive anteroposterior displacement of the brain within the skull.

A violent shaking :)
of the head (e.g., child abuse or car accident) and commonly occurs in alcoholics and elderly.

Due to the shrinking in the brain size >>the brain become more freely movable inside the cranial cavity >> higher chance in tearing these bridges veins

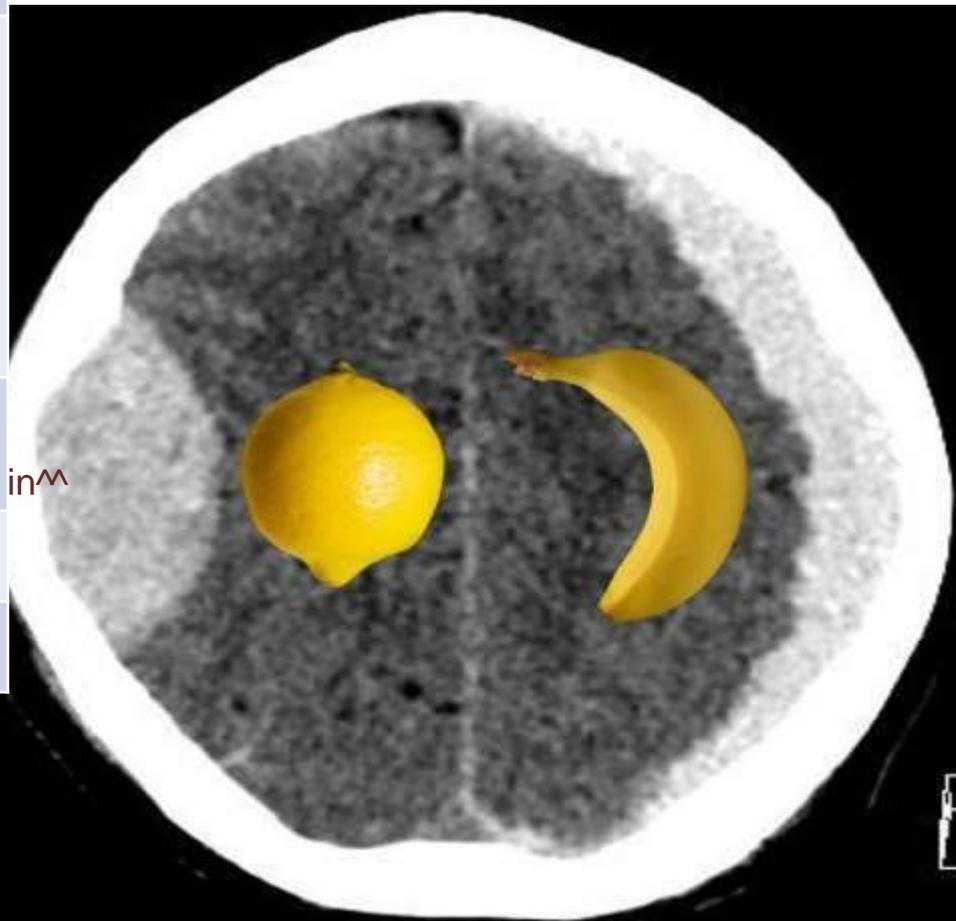
Blood accumulates in the potential space between the dura and the arachnoid

not real space



Epidural	Subdural
Between the skull and dura matter (between the periosteal and meningeal layers of dura matter)	Between dura and arachnoid matter
Rupture to meningeal vessels (middle meningeal A)	Rupture to cerebral veins (bridging veins) while approaching the venous sinus (superior cerebral veins)
Lense shaped (Biconvex)	Crescent shaped it hugs the contour of the brain in^^
Well localized	Poorly localized
Mostly arterial	Mostly venous

Read only

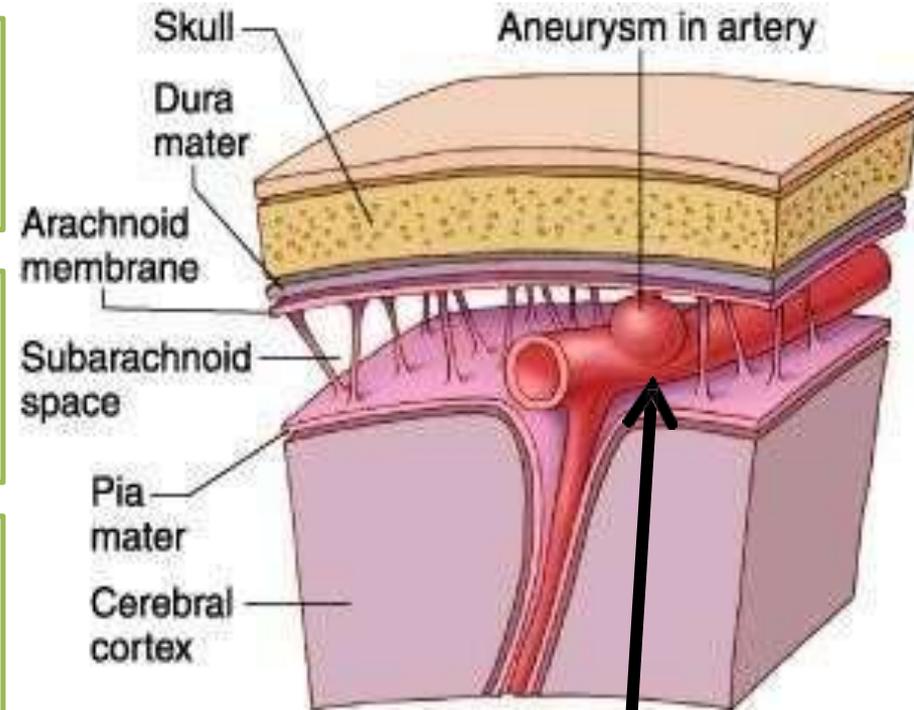


Subarachnoid hemorrhage

Extravasation of blood into the subarachnoid space between the pia and arachnoid

Occurs in the setting of a ruptured cerebral aneurysm or arteriovenous malformation

The diagnosis is established by withdrawing heavily blood-stained cerebrospinal fluid through a lumbar puncture (spinal tap).



Read only

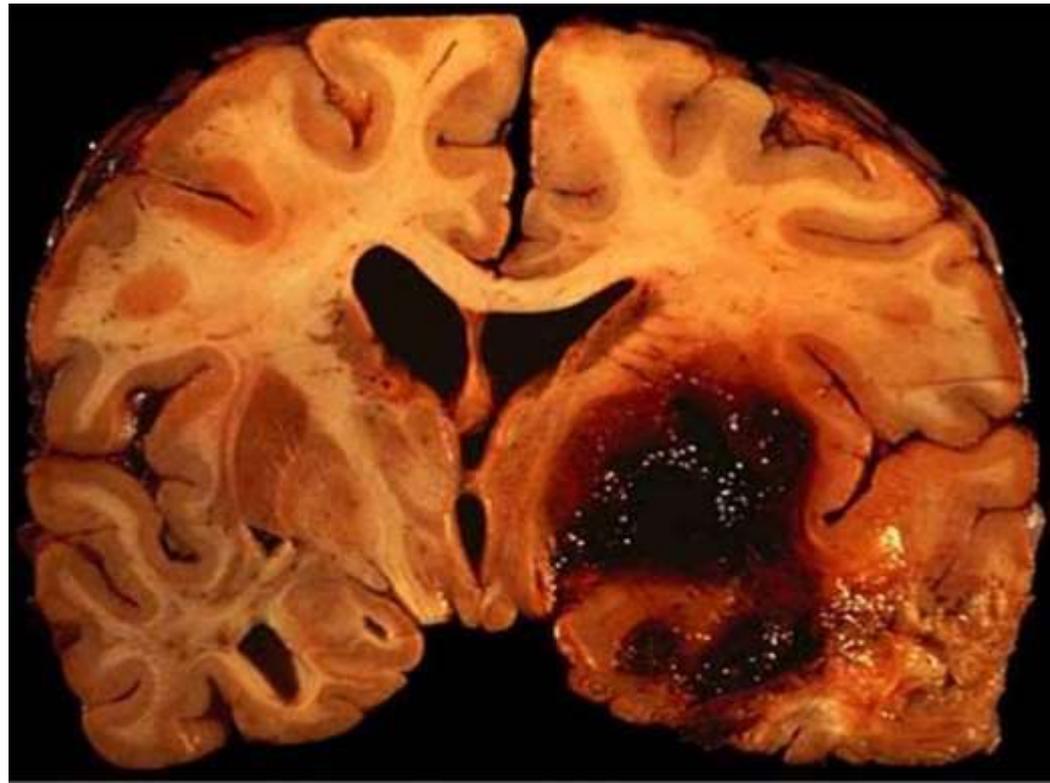
the symptoms of the subarachnoid Hemorrhage it needs time (even months) to appear it needs time to accumulate the blood in the cranial and spinal subarachnoid spaces to make irritation of the dura and cause headache

Note: cerebral arteries, veins and cranial nerves pass through the subarachnoid space

Cerebral hemorrhage

- Caused by bleeding within the brain tissue itself => (branches of cerebral veins)
- Most commonly caused by hypertension

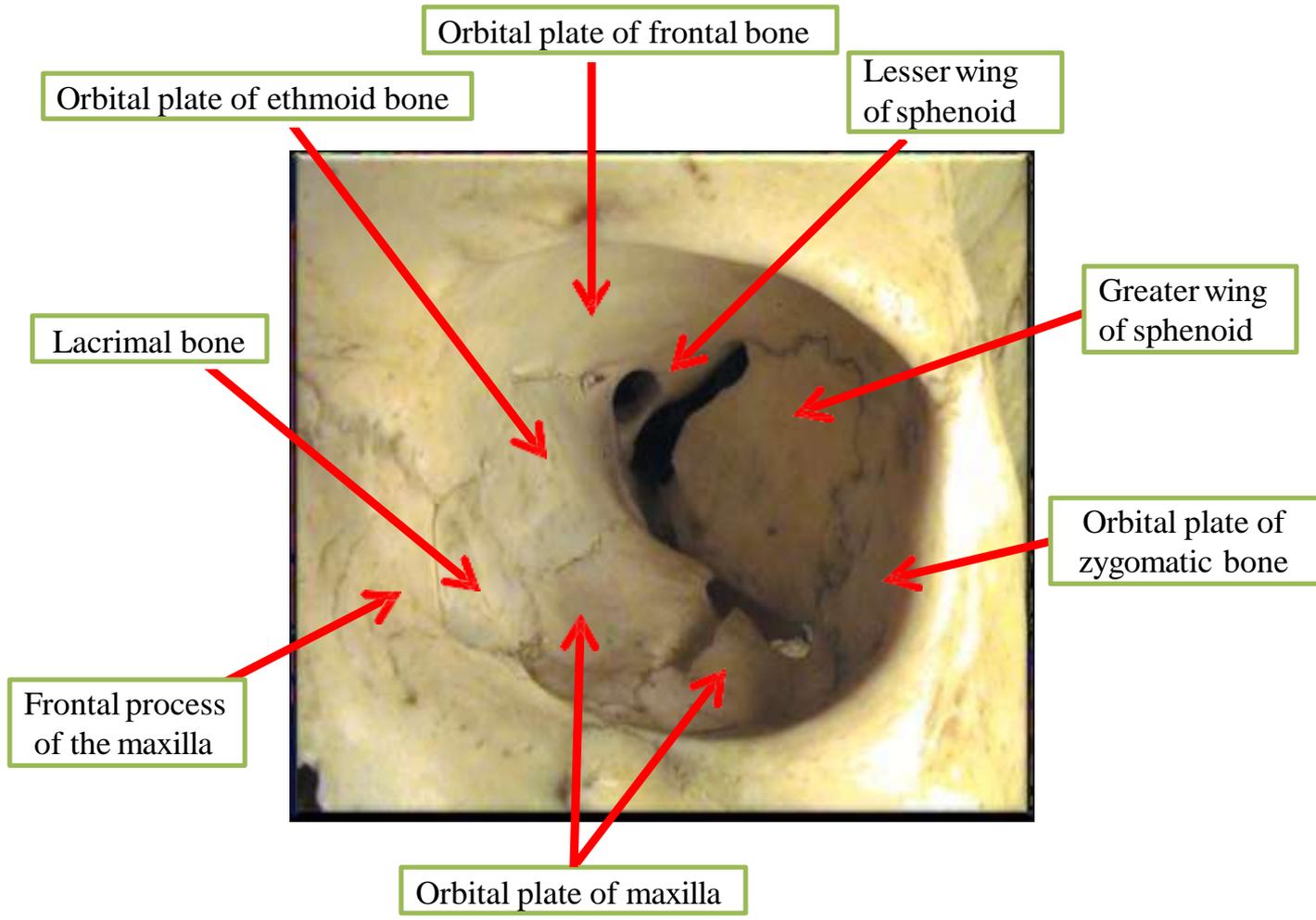
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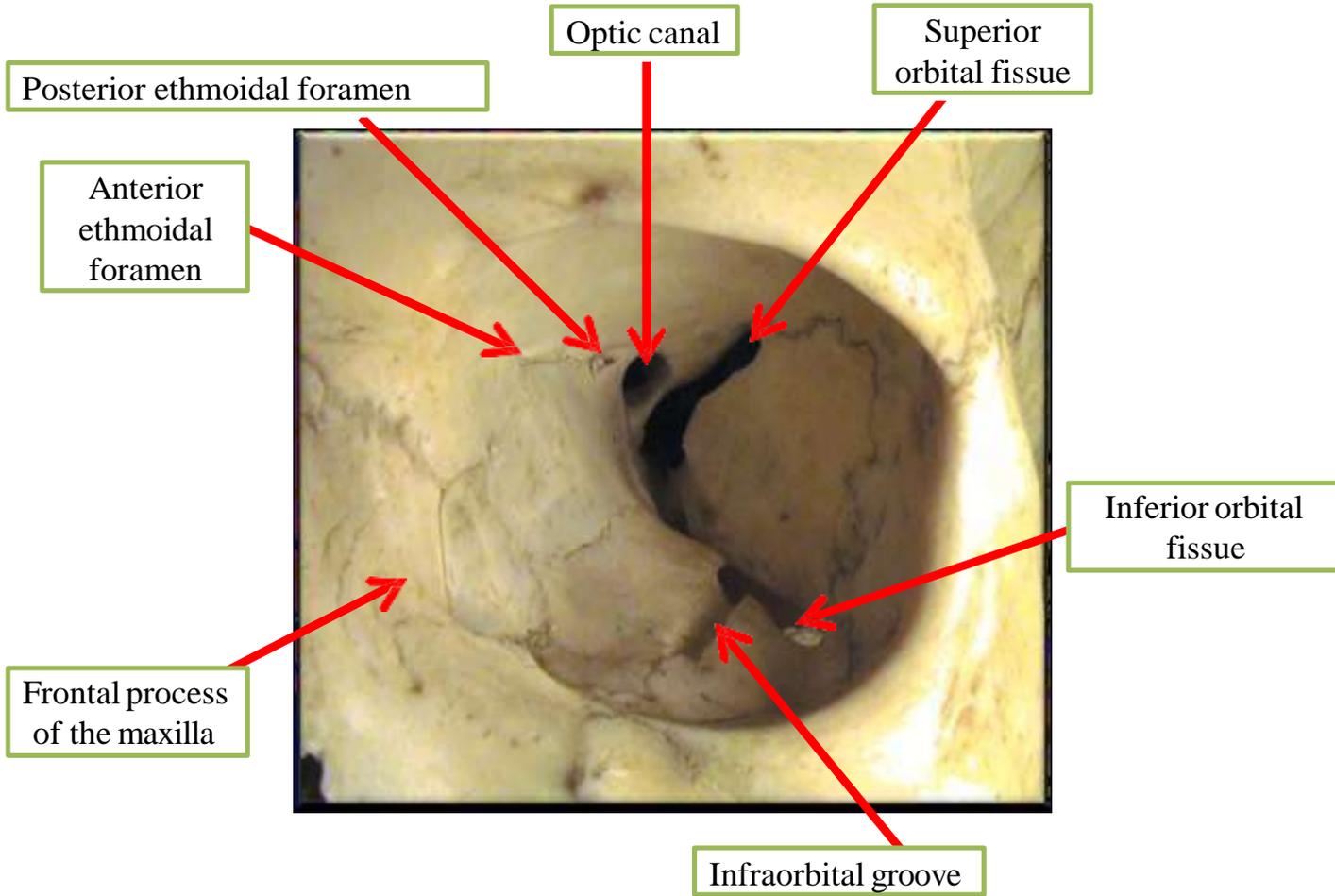


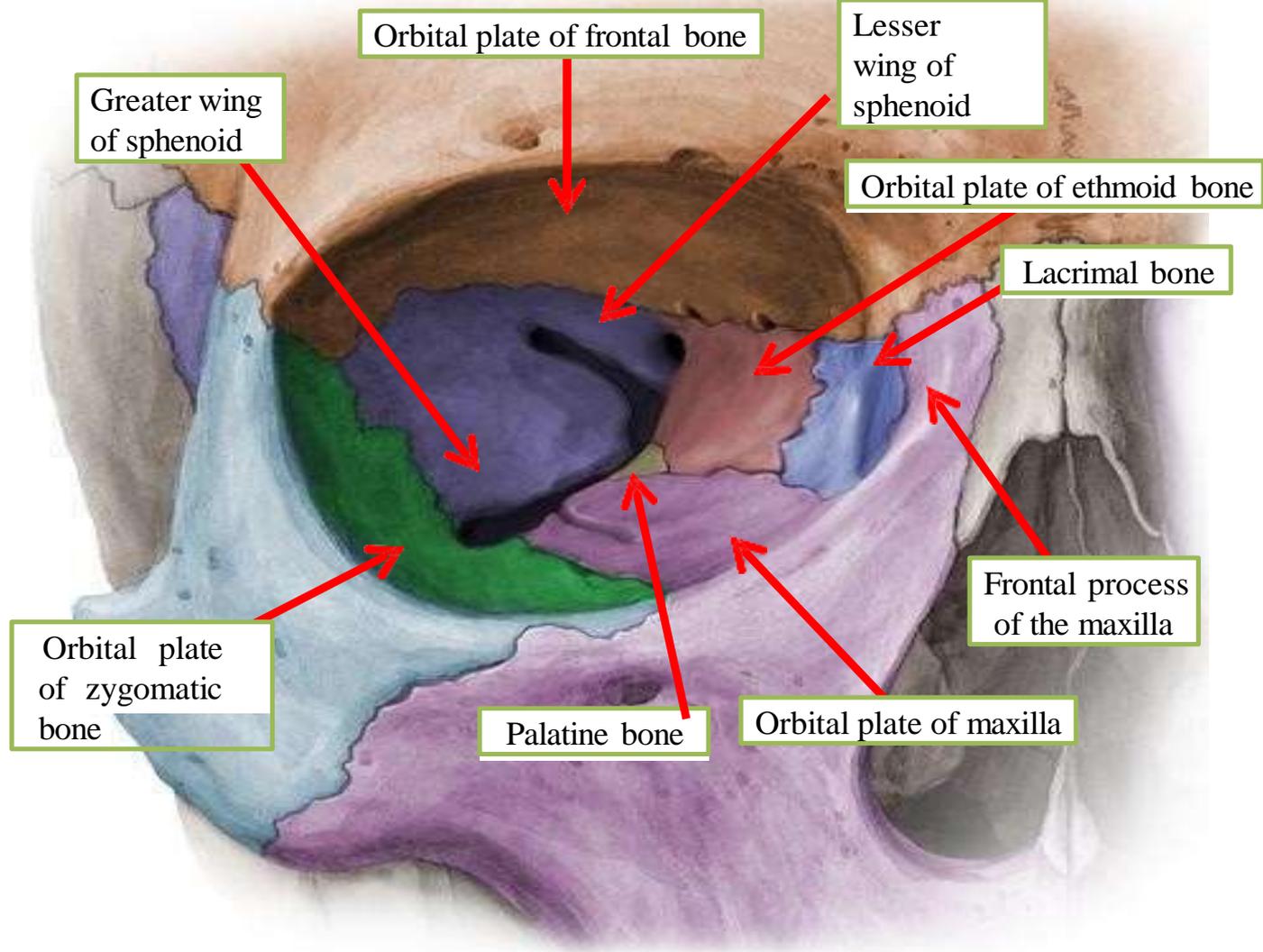


The orbit-1

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Orbit

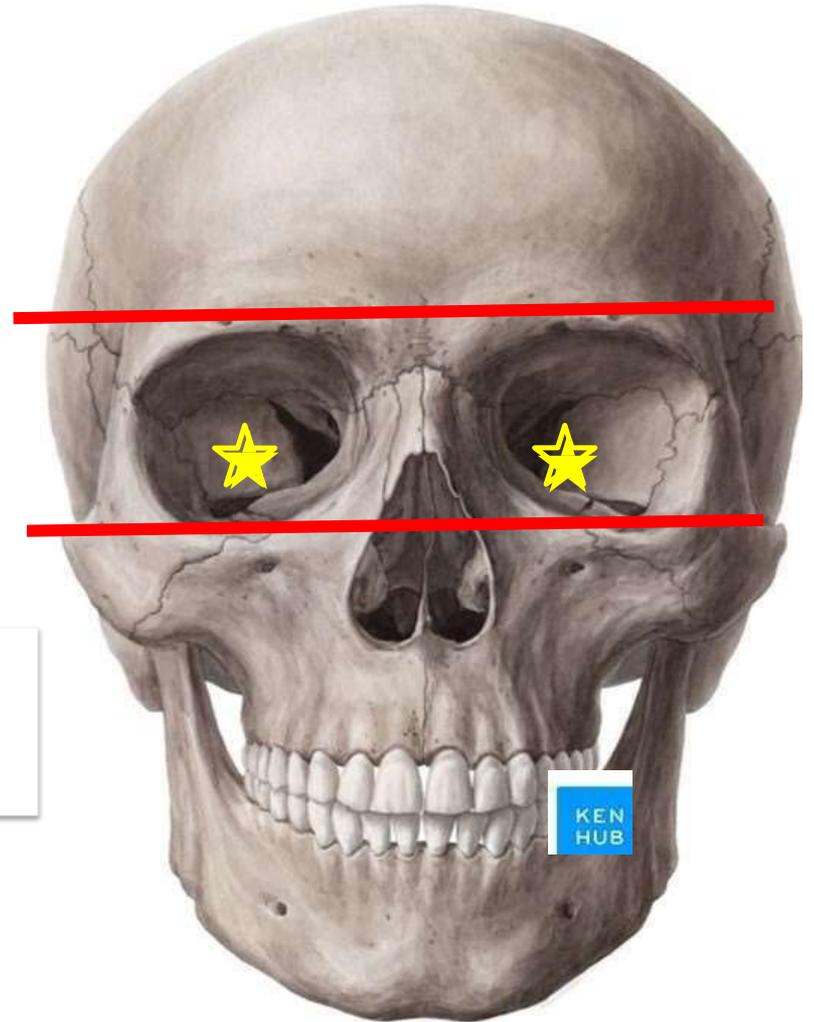
The orbits are bilateral structures below the anterior cranial fossa and anterior to middle cranial fossa

The bony orbit is pyramidal in shape, with its base opening anteriorly onto the face and its apex extending in a posteromedial direction

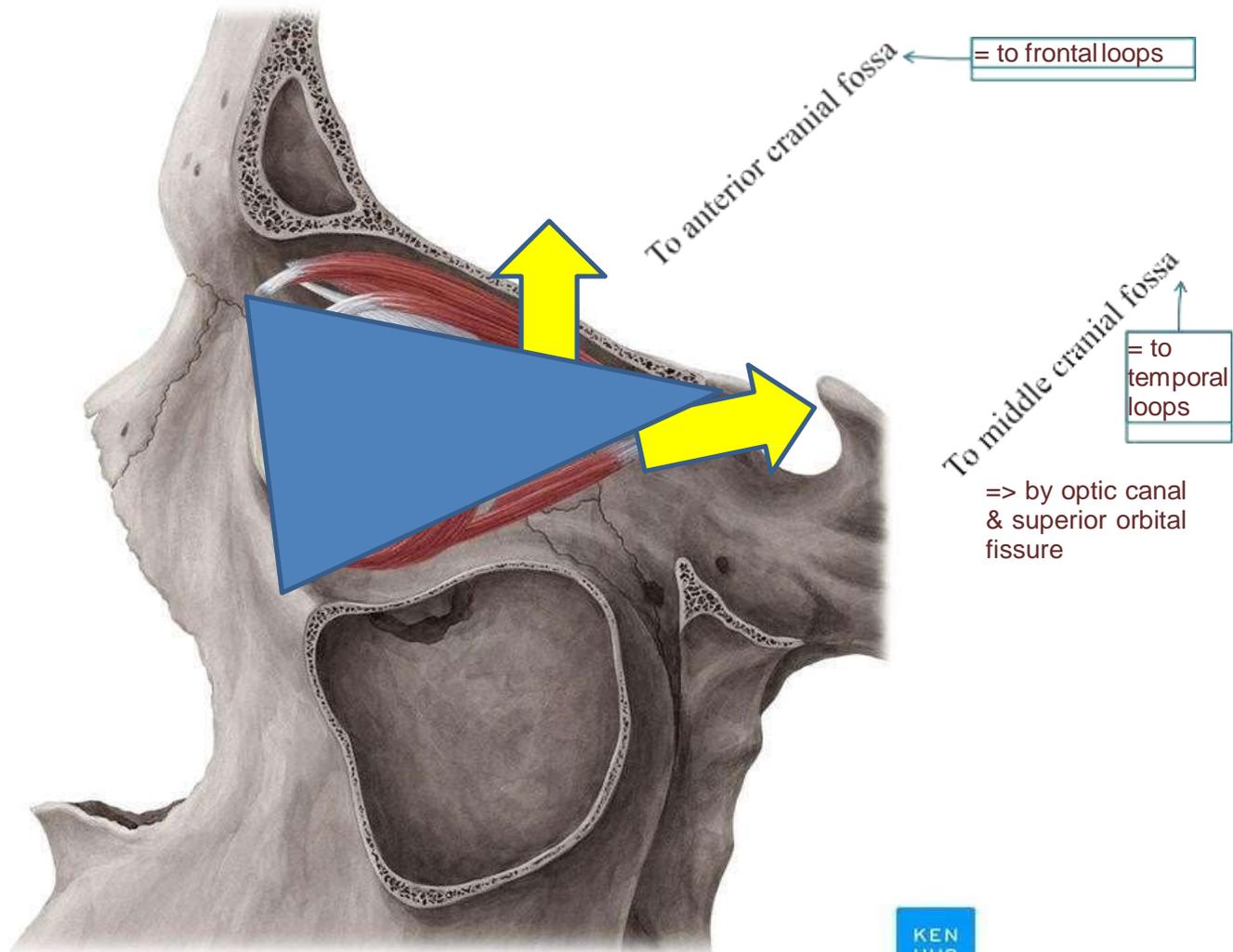
Has medial, lateral, superior (roof), inferior (floor) walls

The apex of the pyramid is the **optic foramen**, whereas the base is the orbital rim

Orbital
Ophthalmic
Ciliary
Optic



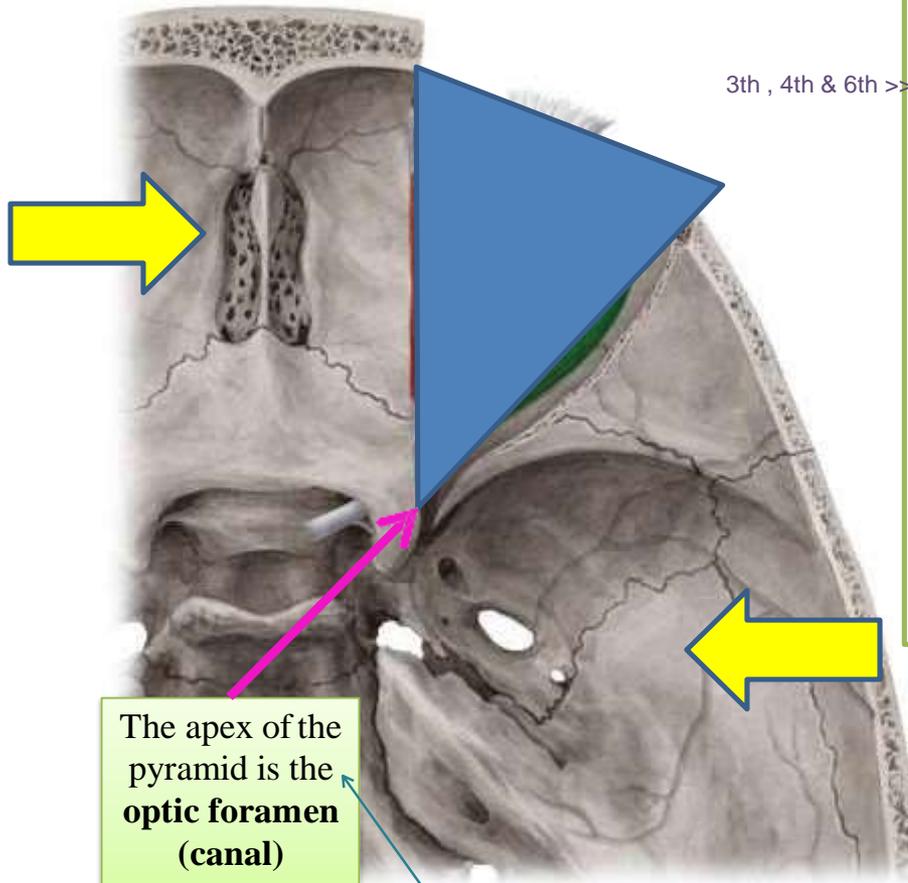
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Contents of the orbit:

1. Eyeball
2. Extraocular muscles => to move the eyeball
3. Intraocular muscles => control the size of the pupil
4. Nerves: Optic, branches of ophthalmic, branches from maxillary, divisions of oculomotor, trochlear, abducens, sympathetic fibers and ciliary ganglion
5. Ophthalmic artery and veins
6. Lacrimal apparatus => located most superior anterior lateral of the orbit >> lacrimal glands to produce the tears
7. Fat => orbital fat for supporting

The apex of the pyramid is the optic foramen (canal)

the apex is directed posteromedially

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