

# **DISCUSSION SESSION: GROSS ANATOMY**

## **ONN BLOCK**

**Sunday Feb 7, 2021**

**Discuss Meninges (including Hematomas), Orbit (including Palsy III, IV, VI)**

# **MENINGES**

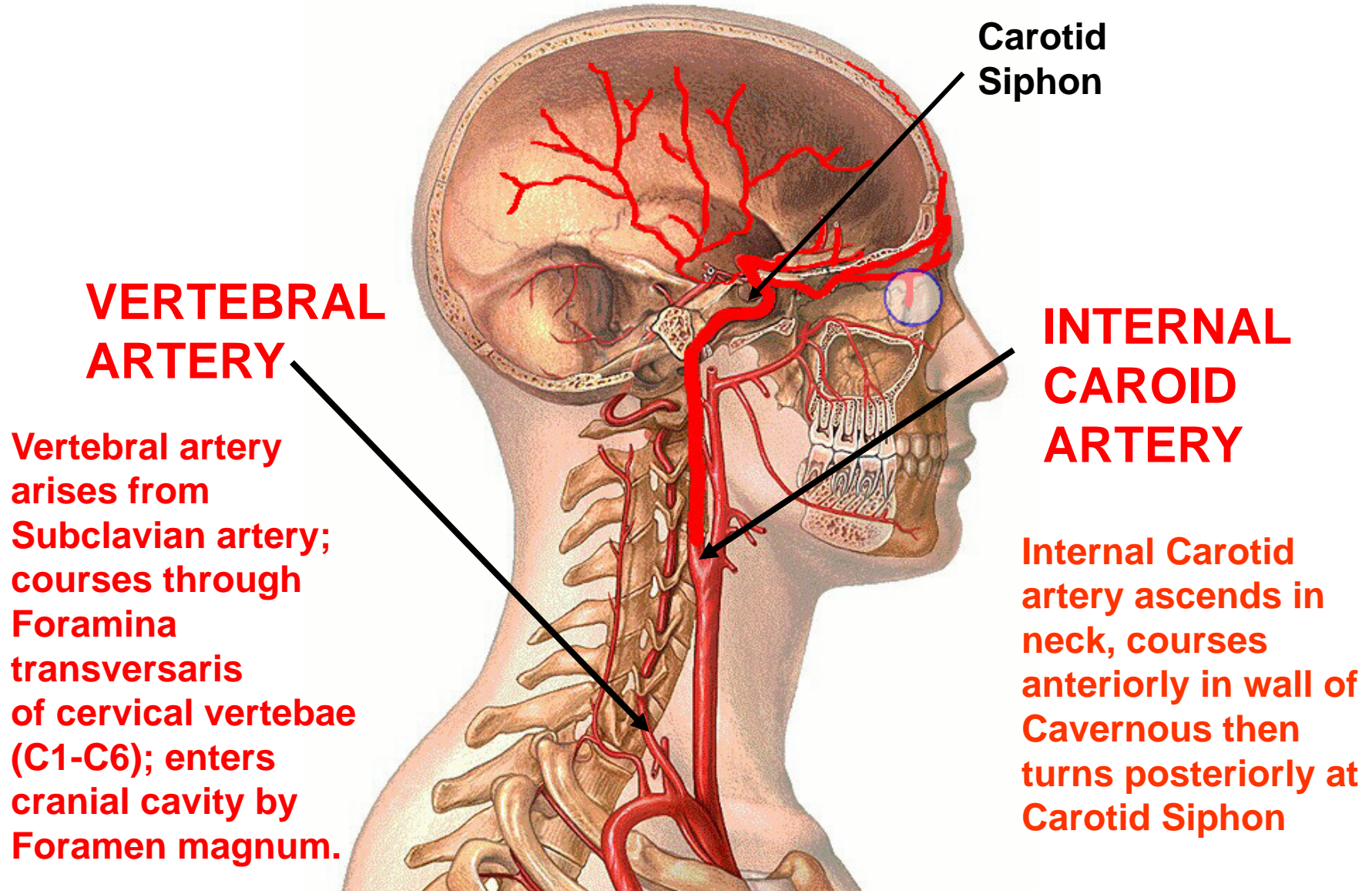
**Pattern of venous drainage sinuses**

**CSF reabsorption**

**Epidural hematoma**

**Subdural hematoma**

# BLOOD SUPPLY TO BRAIN



# VENOUS DRAINAGE OF BRAIN – MOST THROUGH VENOUS SINUSES

## SUPERIOR SAGITTAL SINUS

INFERIOR SAGITTAL SINUS

CAVERNOUS SINUS

falx cerebri

STRAIGHT SINUS

tentorium cerebelli

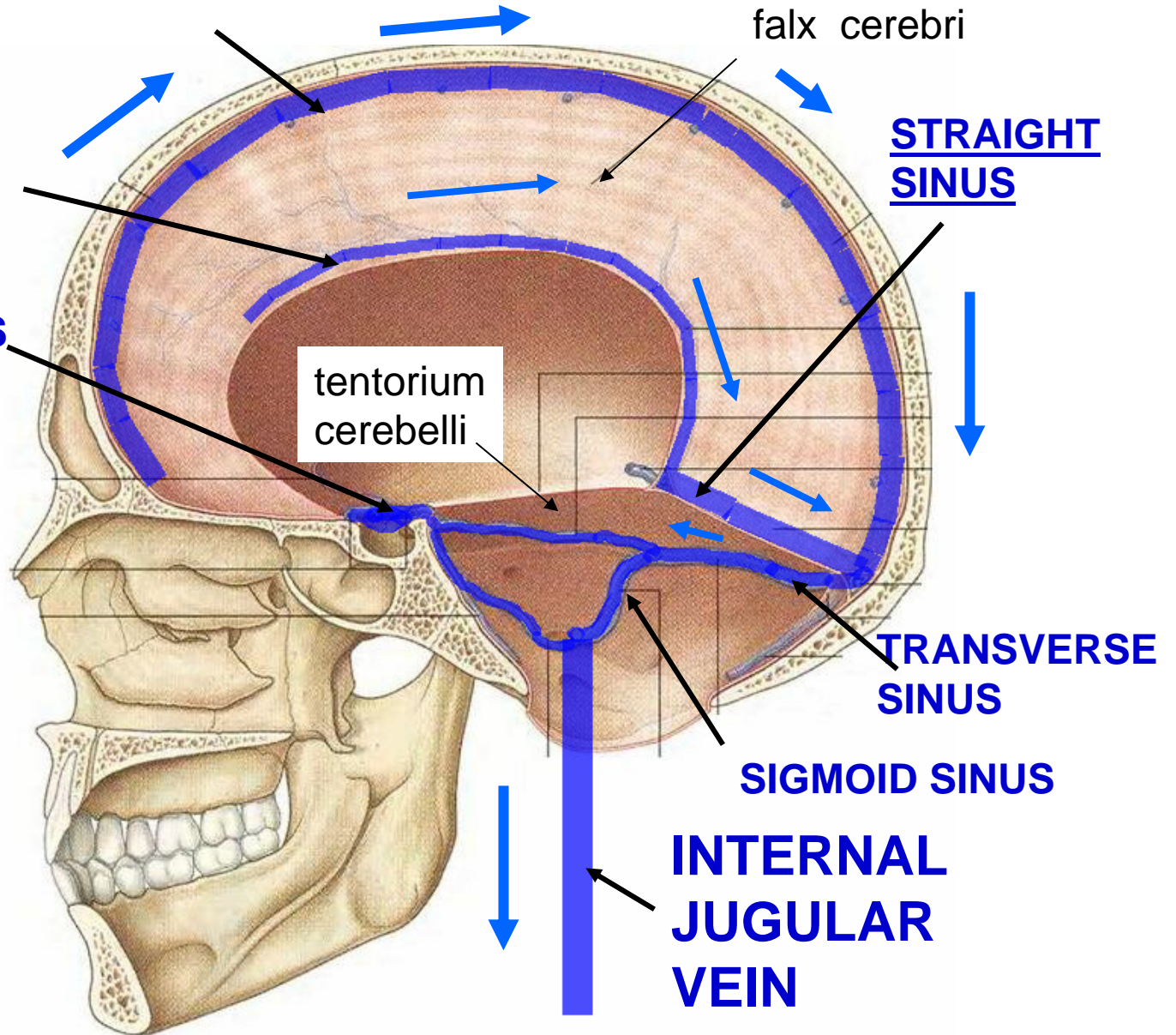
TRANSVERSE SINUS

SIGMOID SINUS

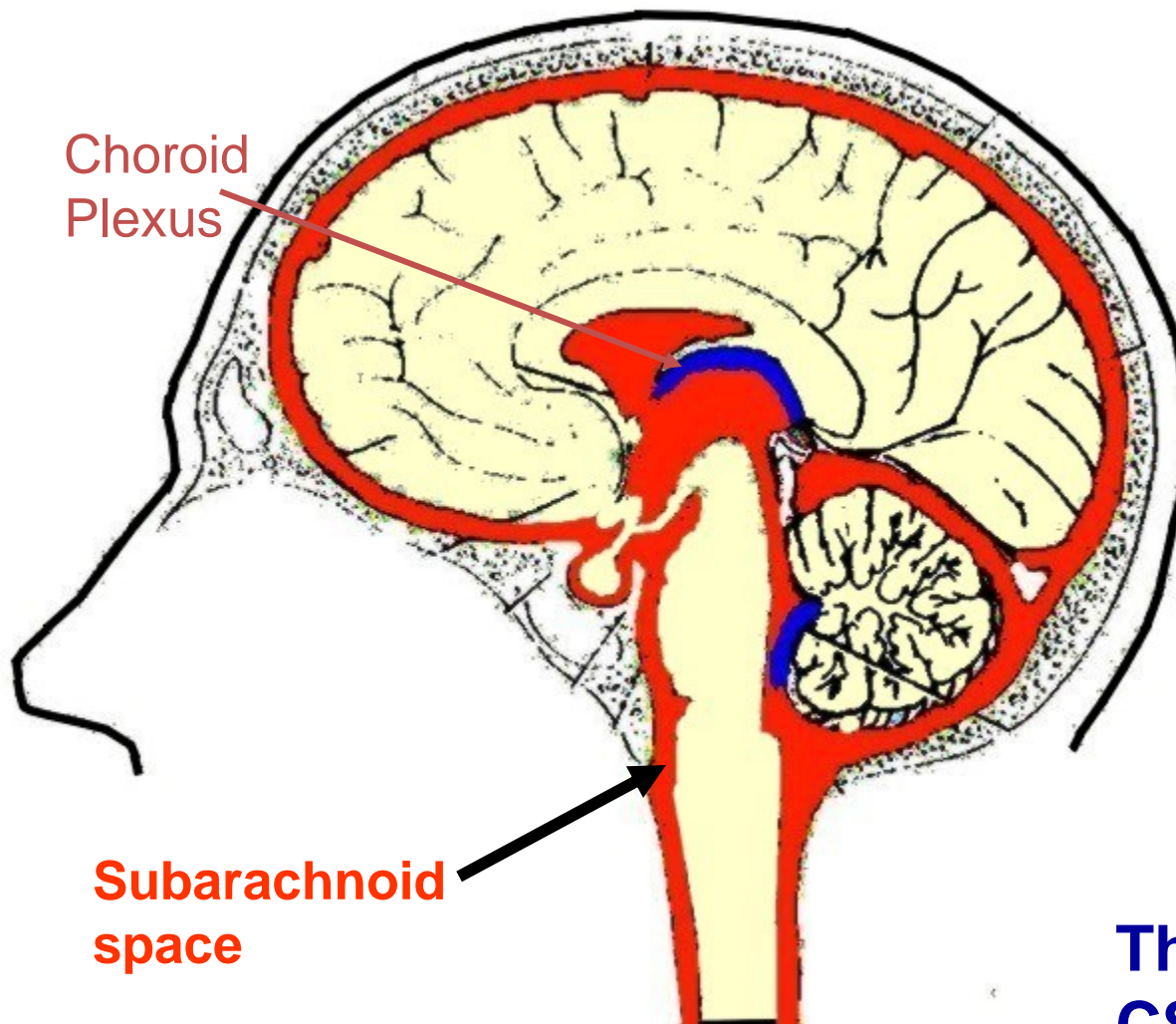
INTERNAL JUGULAR VEIN



**NOTE: INFERIOR SAGITTAL SINUS DOES NOT DIRECTLY JOIN SUPERIOR SAGITTAL SINUS; INSTEAD JOINS GREAT CEREBRAL VEIN TO FORM STRAIGHT SINUS**



# CEREBRO-SPINAL FLUID (CSF)



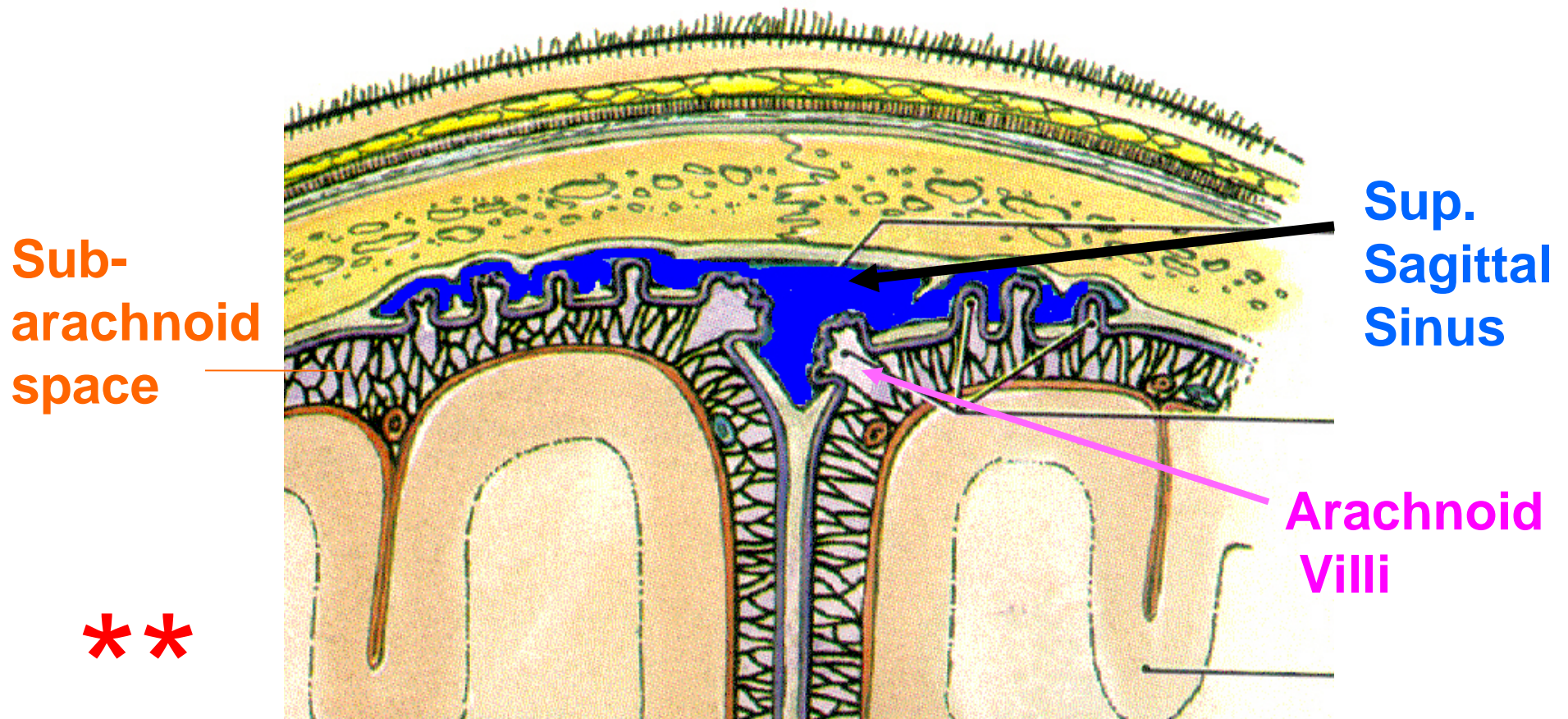
Choroid  
Plexus

Subarachnoid  
space

made inside  
brain in Choroid  
Plexus; flows  
out of brain to  
Subarachnoid  
Space

The brain floats in  
CSF - Shock  
Absorber

# CSF REABSORBED INTO VENOUS SINUSES



**CSF reabsorbed into venous sinuses (ex. Sup. Sagittal sinus) at Arachnoid Villi; - In elderly arachnoid villi can become calcified- Arachnoid Granulations; Reduced Re-Absorption can produce Communicating Hydrocephalus**

# CSF REABSORBED INTO VENOUS SINUSES

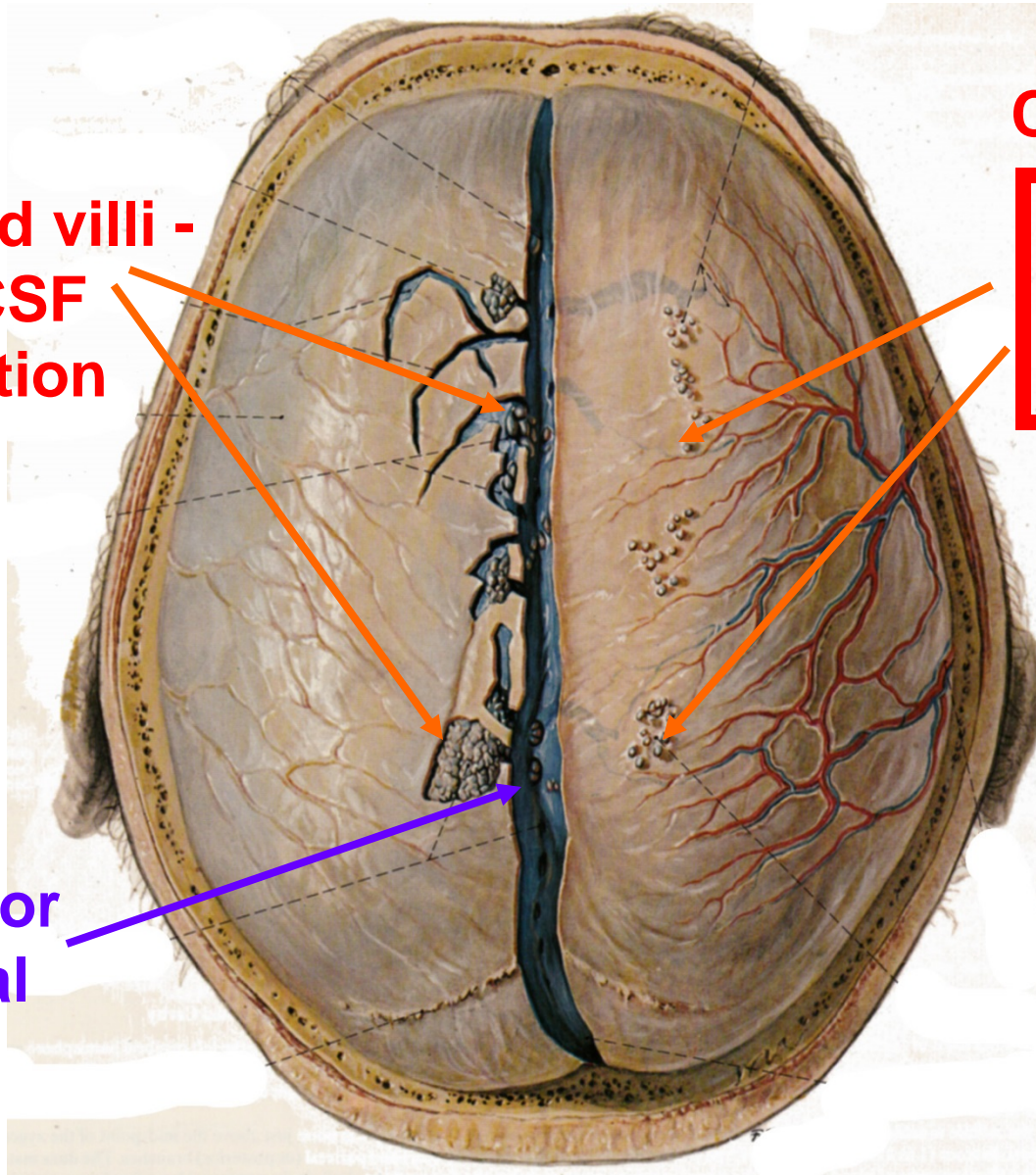
Arachnoid villi -  
sites of CSF  
reabsorption

CLINICAL \*\*

Arachnoid villi -  
sites of CSF  
reabsorption

Superior  
Sagittal  
Sinus

Calcification of  
Arachnoid Villi is  
common in  
elderly; can cause  
hydrocephalus  
due to decreased  
reabsorption of  
CSF



# **BLEEDING INSIDE SKULL**

**1- EPIDURAL HEMATOMA**

**2- SUBDURAL HEMATOMA**

**3- SUBARACHNOID BLEEDS**



## PRACTICE QUESTION CLINICAL VIGNETTE

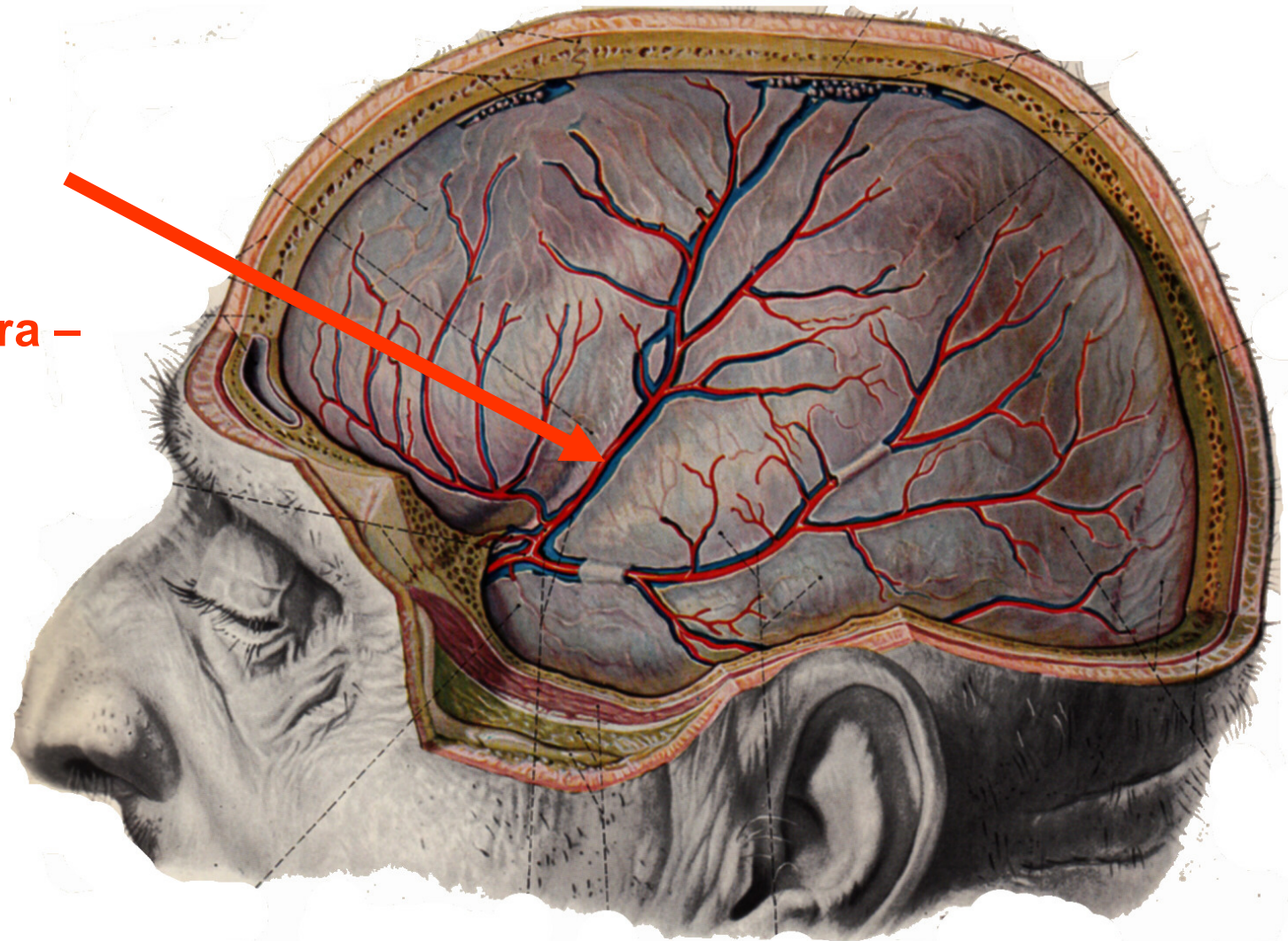


A person is in an automobile accident and gets struck on the side of the head. The patient refuses to be taken to the hospital and instead demands to simply go home and lie down for a while. **Within hours, the person is rushed to the hospital after losing consciousness.** The image is a CT scan section at the level of the cranial cavity. The physician suspects that this is a hematoma that has resulted from tear of a vascular structure. Which of the following describes the type of hematoma and the vascular structure that was damaged?

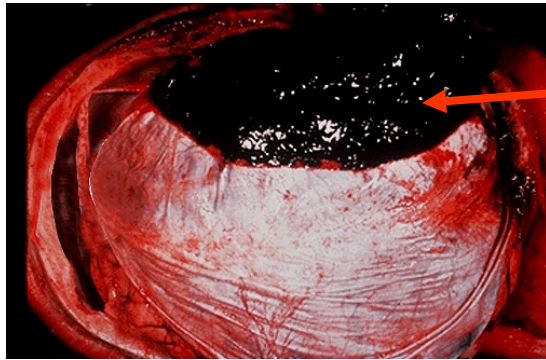
- A. Subdural hematoma, Ophthalmic artery
- B. Subdural hematoma, Middle Meningeal artery
- C. Epidural hematoma, Ophthalmic artery
- D. Epidural hematoma, Middle Meningeal artery
- E. Epidural hematoma, Deep Temporal artery

# HEMATOMAS - INTERNAL BLEEDS

**Middle  
Meningeal  
Artery –  
courses  
outside dura –  
supplies  
calvarium**



**EPIDURAL HEMATOMA - bleeding between dura and bone**



# EPIDURAL HEMATOMA

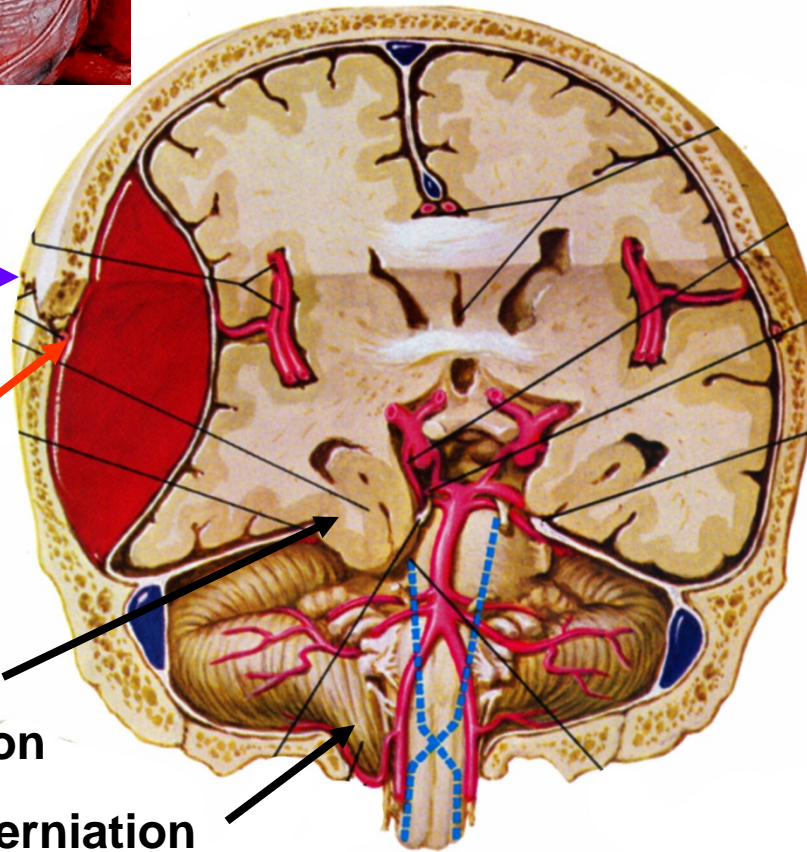
- 1) Skull fracture near Pterion
- 2) Tear Middle Meningeal Artery
- 3) Blood 'peels' dura from bone
- 4) Lens shaped (biconvex) mass on CT

Skull Fracture Near Pterion

Tear Middle Meningeal Artery

Uncal herniation

Tonsillar herniation

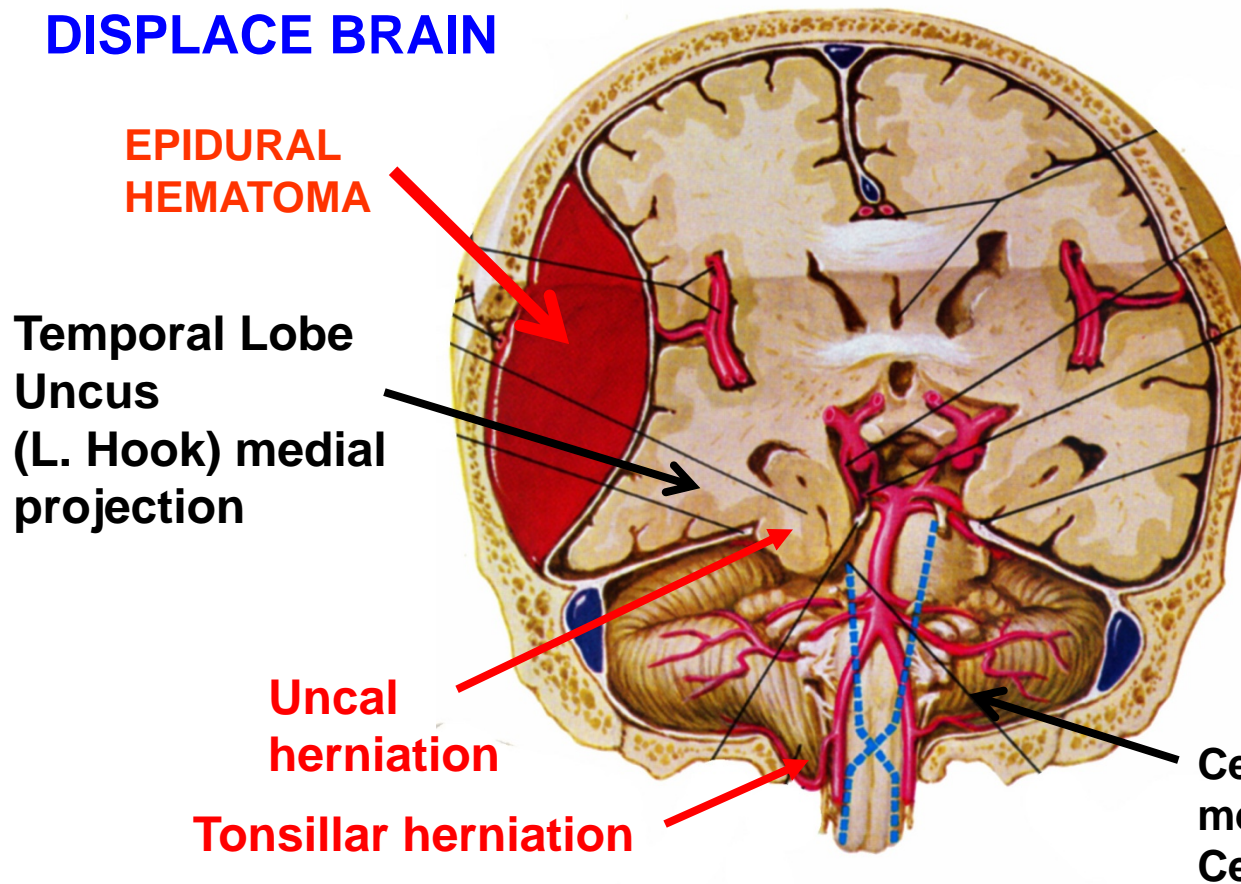


Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident); patient lucid at first; can be fatal within hours if herniation occurs

**EPIDURAL HEMATOMA – \*\***  
1) **ARTERIAL – often MIDDLE MENINGEAL ARTERY**  
2) **'LENS' SHAPED MASS**  
3) **RAPID**

# EPIDURAL HEMATOMA

MASS OF BLOOD CAN  
DISPLACE BRAIN



6) Herniation -

i. Uncal herniation -  
push Temporal lobe  
(uncus) through  
Tentorial Notch

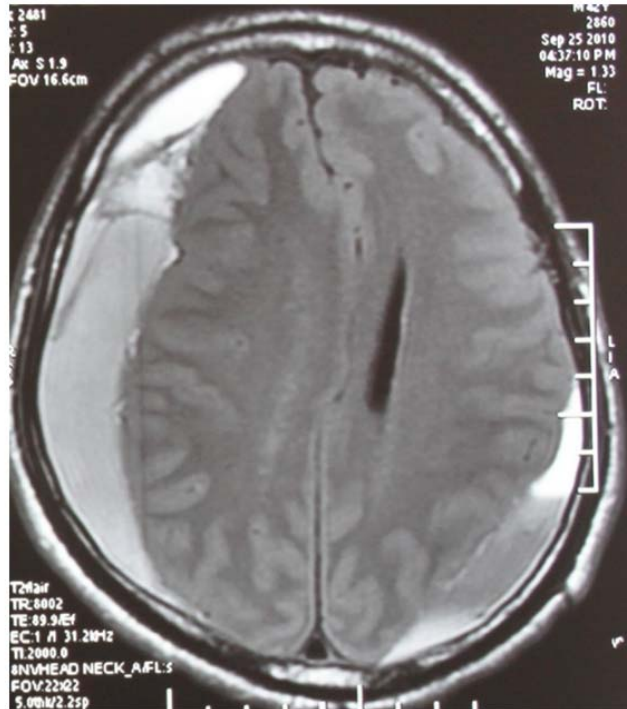
ii. Tonsillar  
herniation -  
push Cerebellum  
(tonsil) through  
Foramen Magnum

Cerebellar Tonsil -  
medial projection of  
Cerebellum

Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident);  
patient lucid at first; can be fatal within hours if herniation occurs



## PRACTICE QUESTION CLINICAL VIGNETTE

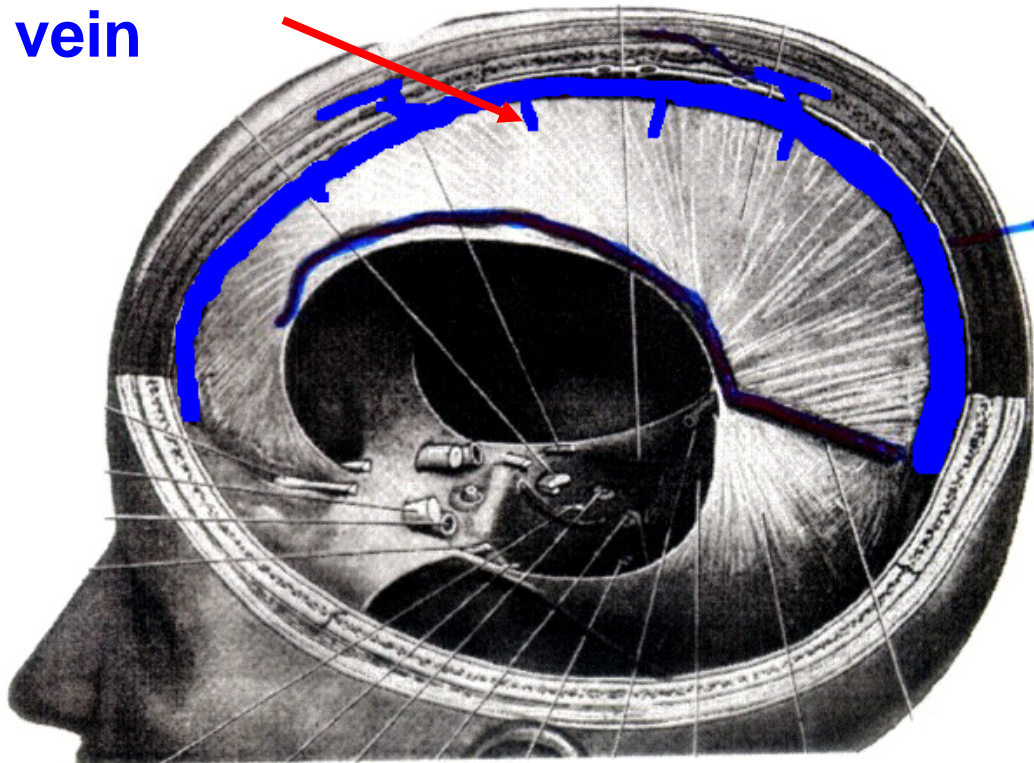


A 63-year-old aging rock musician fell off the stage during a concert tour and his head struck a large speaker in front of the stage. While he felt fine but bruised on the day of the fall, **within the next week he developed a bad headache** and was more verbally incoherent than usual. X rays taken at the hospital showed no fractures of the skull but there was evidence of papilledema. The image above is an MRI image from a series that was subsequently ordered. Damage to which of the following vessels is most likely to account for the symptoms?

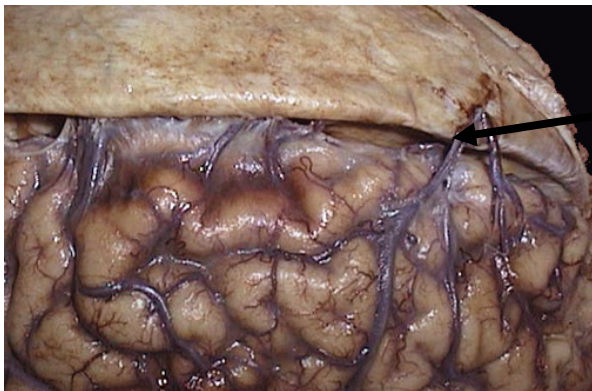
- A. Internal Carotid Artery
- B. Internal Jugular Vein
- C. Vertebral Artery
- D. Superficial Temporal Artery
- E. 'Bridging' Vein or Venous Sinus

# SUBDURAL HEMATOMA

'Bridging'  
vein



- bleed into potential space between Dura and Arachnoid
- from **tear 'Bridging' vein or sinus \*\***
- bleeding often **slow**
- chronic subdural hematomas can remain undetected



'Bridging'  
vein

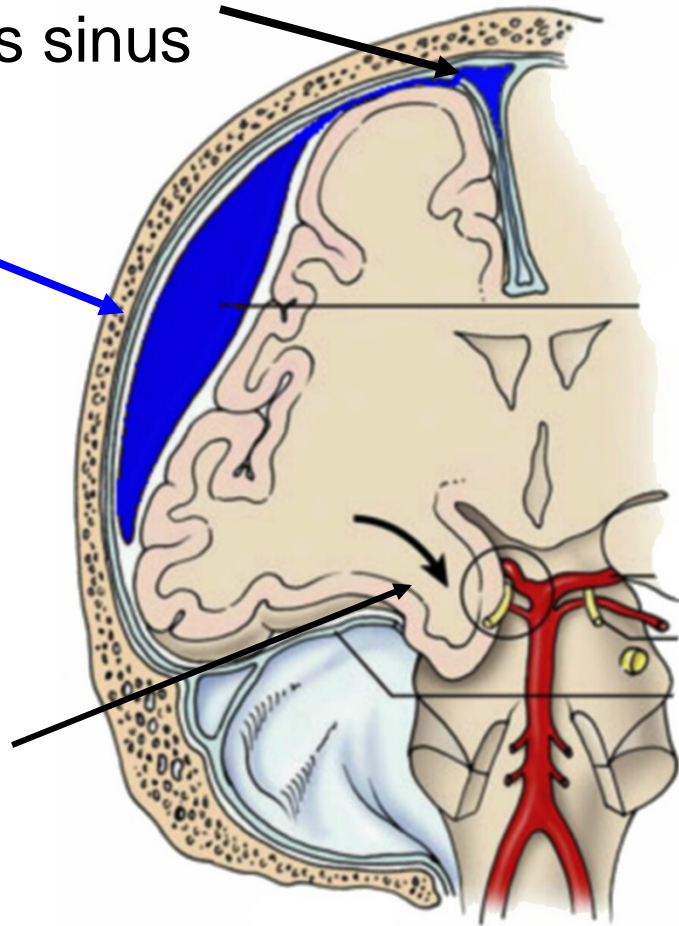
Photo from lecture of Dr. Nancy Norton

# SUBDURAL HEMATOMA

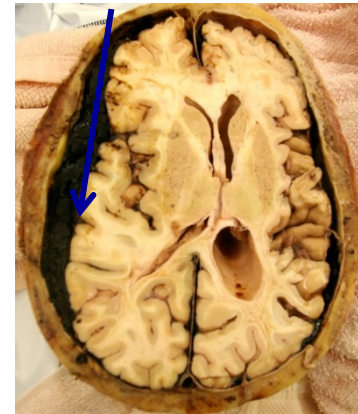
Tear 'bridging' vein  
or venous sinus

Crescent  
shaped  
hematoma  
on CT/MRI

Herniation  
of uncus (L.  
hook) of  
temporal  
lobe  
through  
Tentorial  
notch



SUBDURAL HEMATOMA  
BLOOD

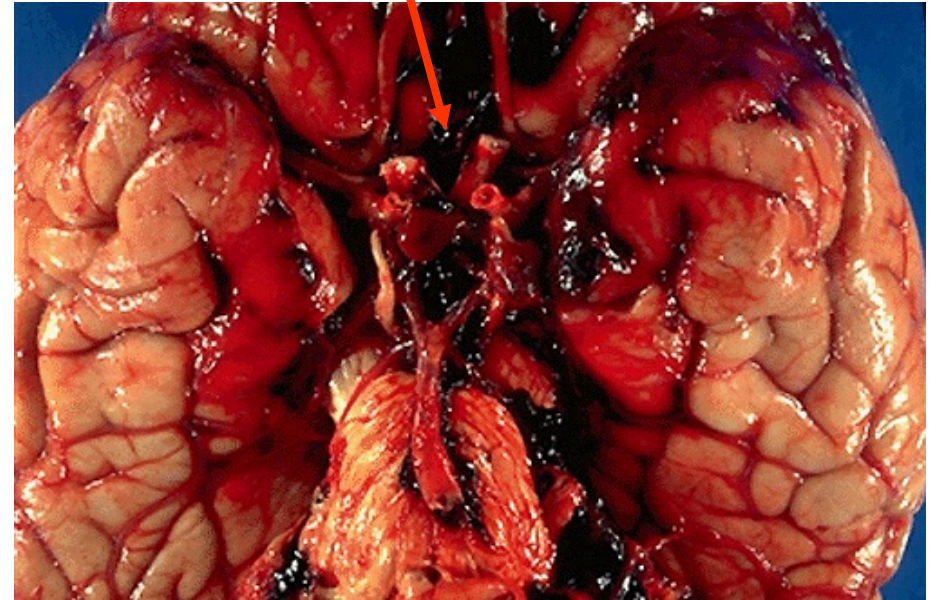
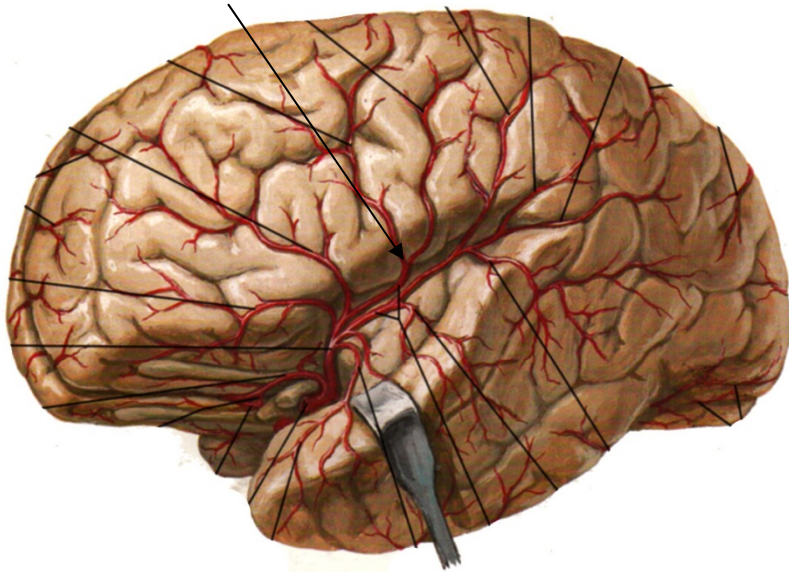


**SUBDURAL \*\*  
HEMATOMA –  
1) VENOUS – often  
BRIDGING VEIN  
2) CRESCENT  
SHAPED MASS  
3) SLOW**

**Clinical: bleeding slow (venous); Chronic Subdural Hematomas  
can remain undetected; can result in herniation if untreated**

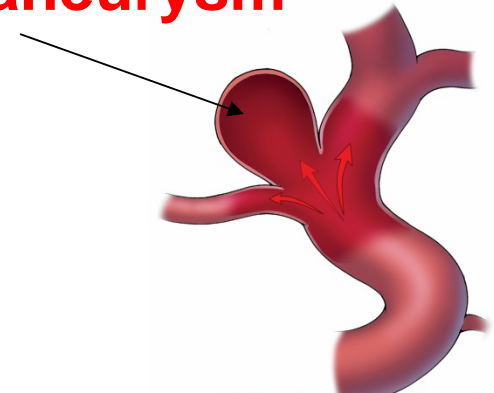
## C. SUBARACHNOID HEMATOMA

Cerebral artery



Tearing cerebral artery or aneurysm (ex, berry aneurysma = swelling of vessel wall) or cerebral vein; If arterial can be rapid and fatal

Berry aneurysm





# ORBIT

**Structure of Eyelids and Gland obstruction**

**Lacrimal Gland and Innervation**

**Action of Ciliary Muscles**

**Eye movement diagram and actions of eye muscles**

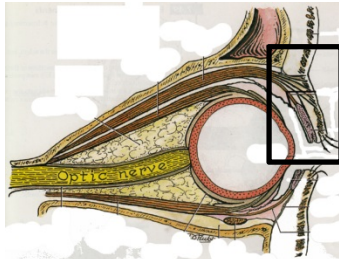
**Nerve Damage III, IV, VI**

**Autonomic Innervation of Eye**

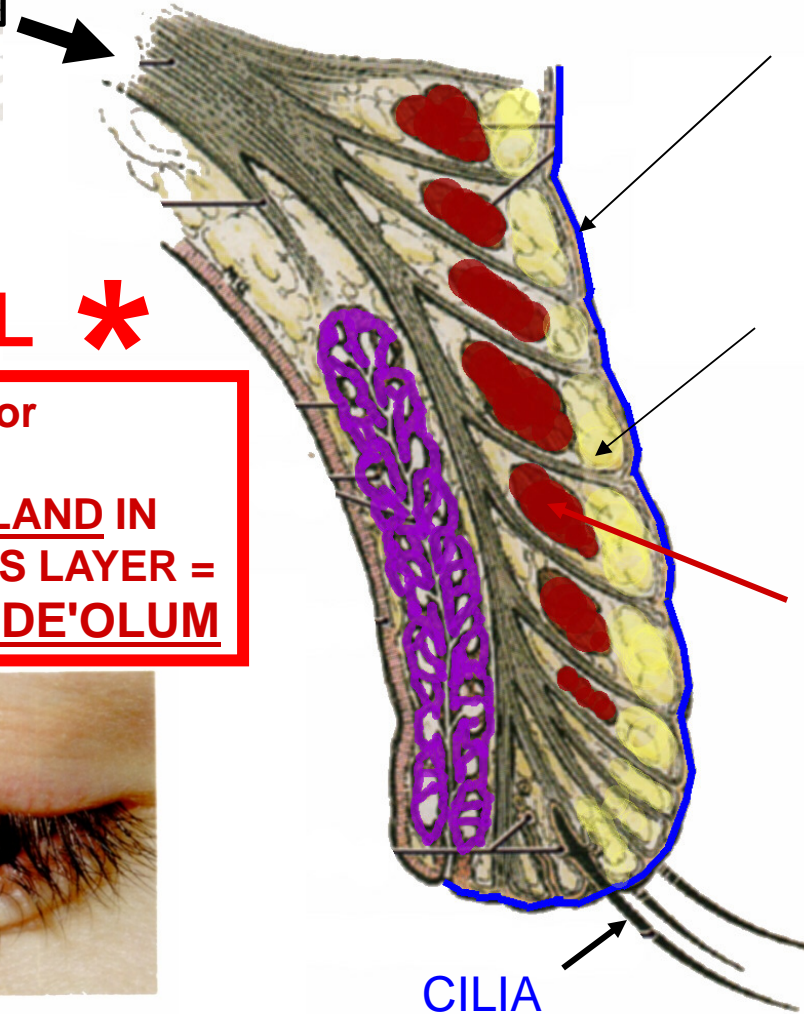


# EYELIDS = PALPEBRAE - LAYERED

EYELIDS PROTECT EYE, MOVEABLE, KEEP CORNEA MOIST



ORIENT - EYELID  
PARASAGITTAL  
SECTION



1. SKIN - CONTAINS EYELASHES (CILIA) AND OPENINGS OF SEBACEOUS, SWEAT GLANDS;

2. SUBCUTANEOUS LAYER - CONNECTIVE TISSUE CONTAINS SEBACEOUS GLANDS; OBSTRUCTION = STYE OR HORDE'OLUM

3. ORBICULARIS OCULI (PALPEBRAL PART) - SKELETAL MUSCLE CLOSES EYE, INNERVATED BY VII - PARALYZE ORBICULARIS OCULI - CAN DAMAGE CORNEA

## CLINICAL \*

OBSTRUCTION or INFECTION OF SEBACEOUS GLAND IN SUBCUTANEOUS LAYER = STYE OR HORDE'OLUM



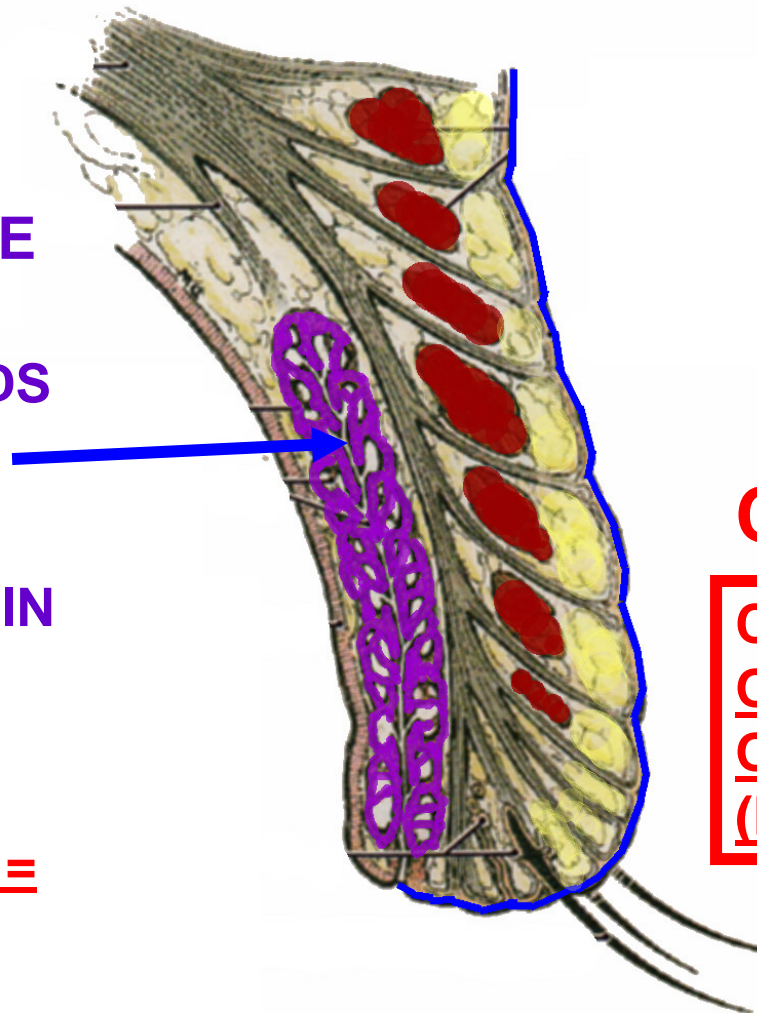
FIGURE 10-10  
Acute hordeolum of upper eyelid.  
From Palay, Krachmer, 1997.

# EYELIDS - LAYERS

TARSAL PLATE - FIBROUS CT 'SKELETON' OF EYELID, DEEP TO ORBITAL SEPTUM

**TARSAL PLATE**  
- CONTAINS  
**TARSAL GLANDS**  
(Meibomian glands)

- KEEP TEARS IN EYE, PREVENT EVAPORATION OF TEARS -  
OBSTRUCTION = CHALAZION



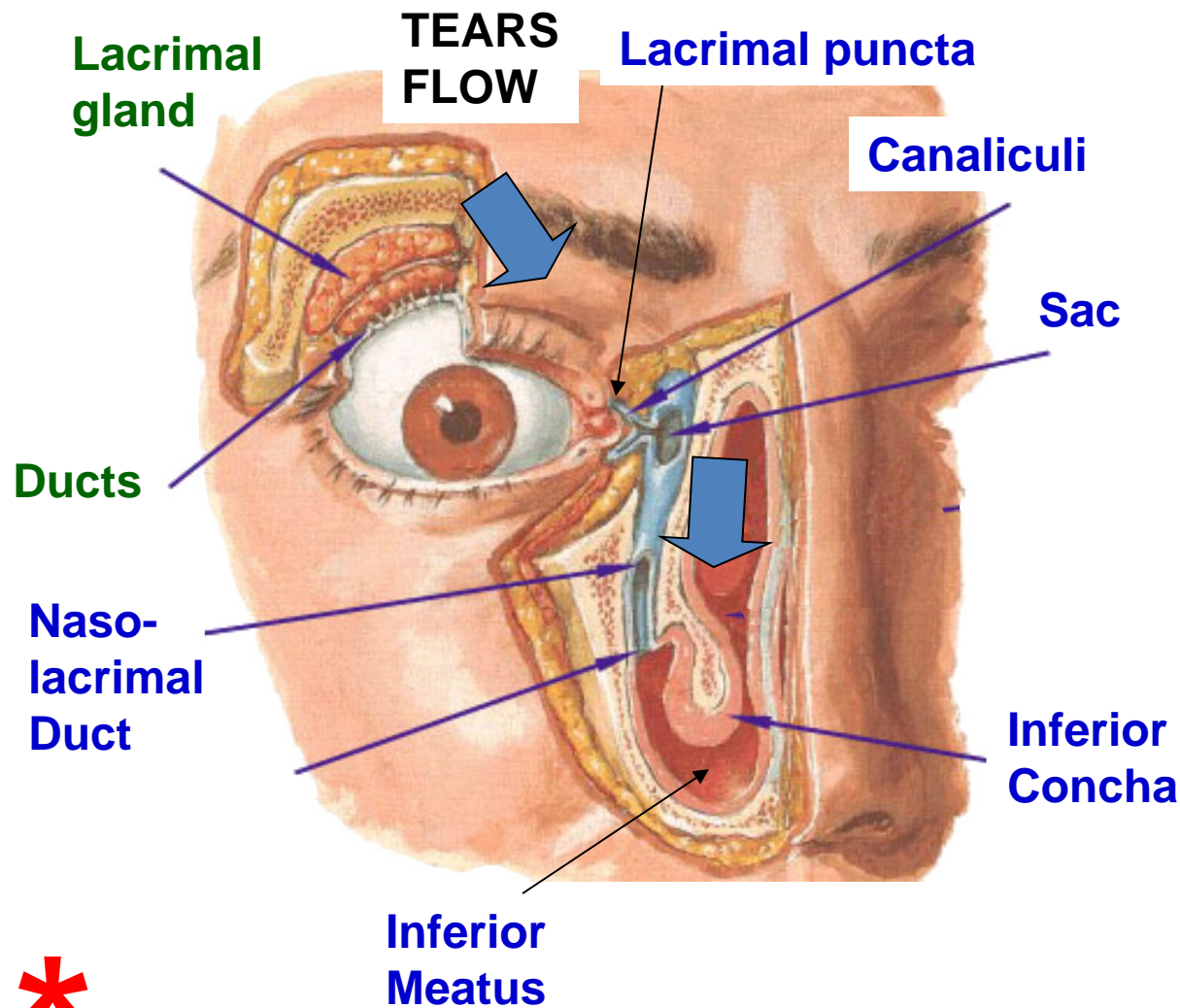
CHALAZION



**CLINICAL \***

**CHALAZION:**  
OBSTRUCTION  
OF TARSAL  
(MEIBOMIAN) GLAND

# LACRIMAL GLAND



- TEARS FLOW ACROSS EYE TO LACRIMAL PUNCTA ON MEDIAL END OF EYELIDS (eyelids meet at MEDIAL CANTHUS);
- TEARS THEN PASS THROUGH LACRIMAL CANALICULI TO LACRIMAL SAC;
- SAC CONNECTS TO NASOLACRIMAL DUCT WHICH DRAINS TO INFERIOR MEATUS OF NASAL CAVITY

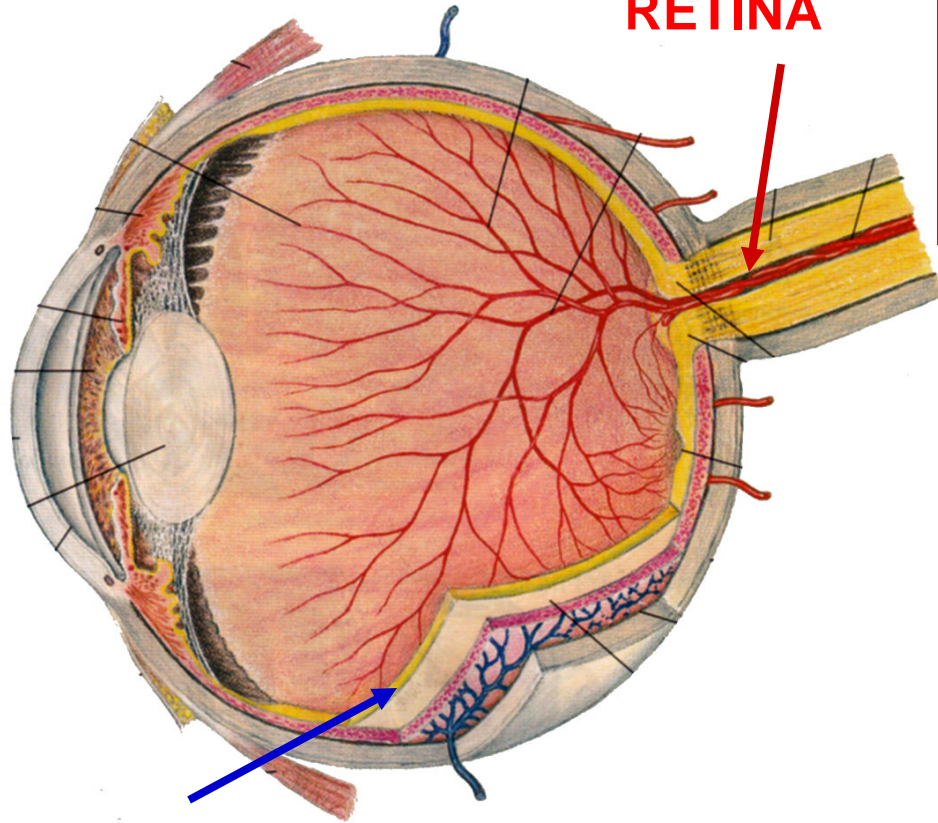


**LACRIMAL GLAND IS INNERVATED BY VII - FACIAL NERVE;**  
**BLOCK VII - DECREASE TEARS; PRESSURE/IRRITATION VII - EXCESSIVE TEARS**

# ARTERIAL SUPPLY – CENTRAL ARTERY OF RETINA

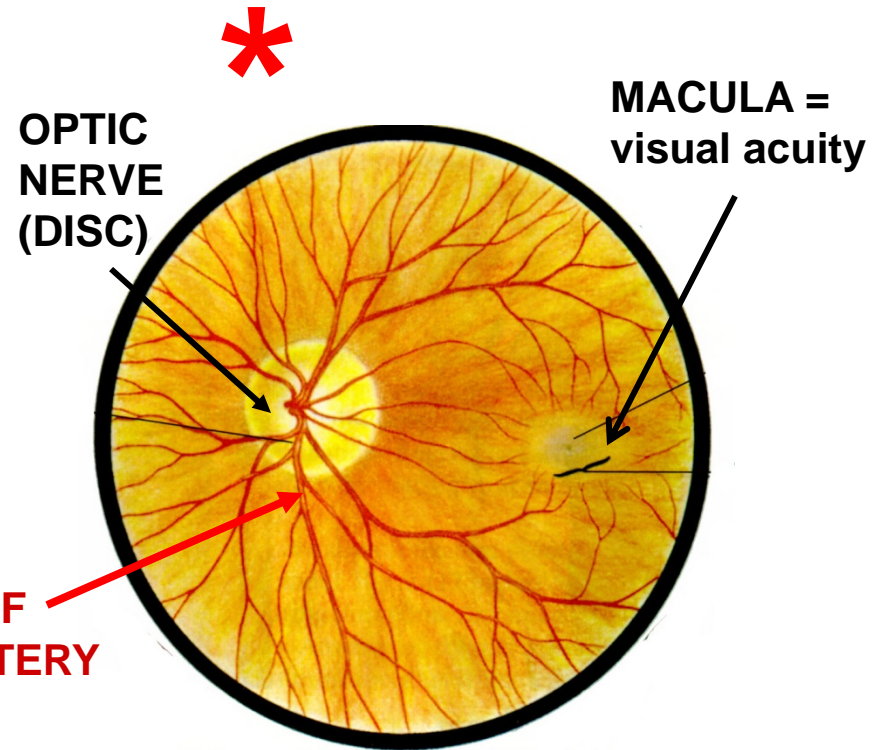
**CENTRAL  
ARTERY OF  
RETINA**

**CONTAINS RODS AND CONES  
(PHOTOSENSITIVE)**  
**CENTRAL ARTERY OF RETINA-**  
**BRANCH OF OPHTHALMIC ART.**  
**NO (OR LIMITED) ANASTOMOSES;**  
**OCCUSION RESULTS IN BLINDNESS**  
**(EXCEPT WHEN SUPPLY FROM CILIO-  
RETINAL ARTERIES)**



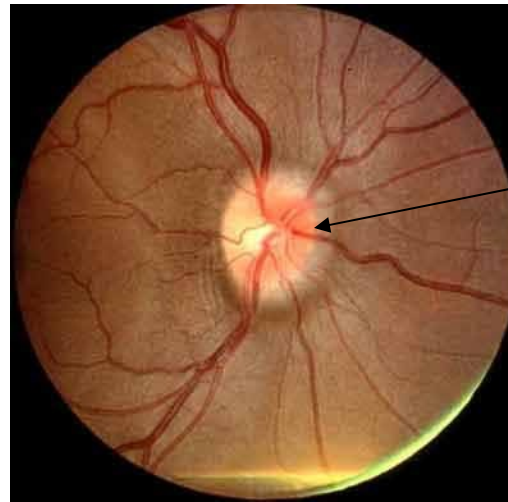
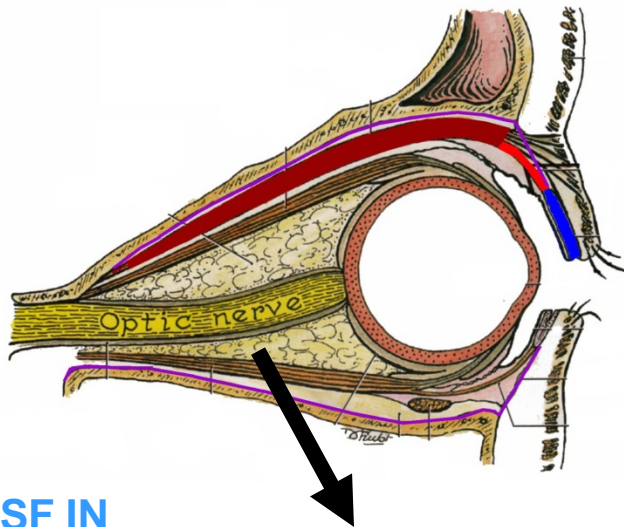
**RETINA**

**BRANCHES OF  
CENTRAL ARTERY  
AND VEIN OF  
RETINA**



**OPHTHALMOSCOPE VIEW**

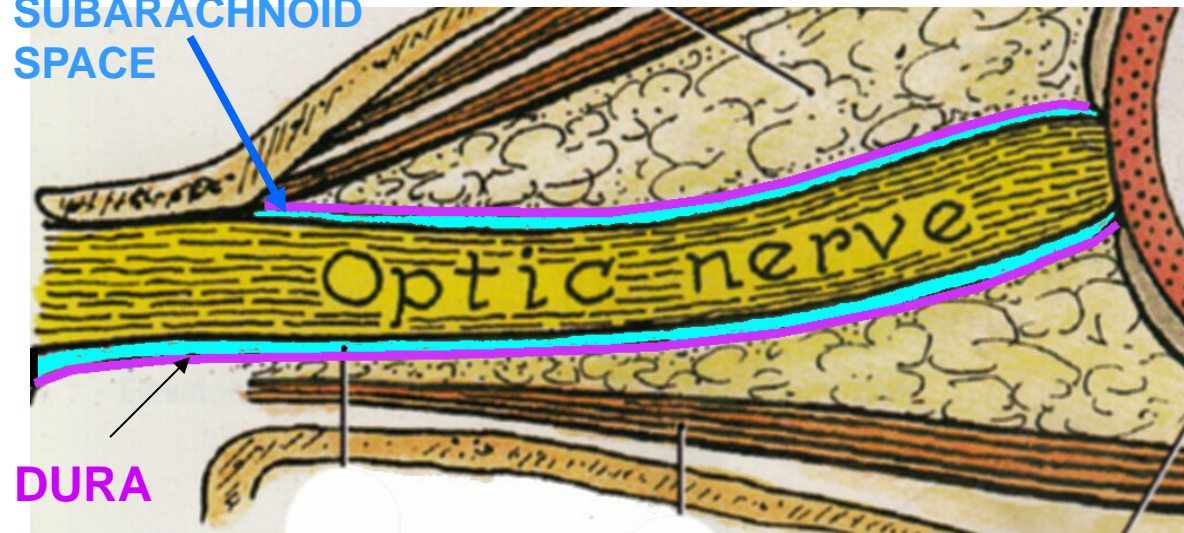
# DIAGNOSE CHANGES IN CSF IN OPHTHALMOSCOPE VIEW



**HYDROCEPHALUS**

**PAPILLEDEMA**  
- engorgement of retinal veins (correspond to branches of central artery)

**CSF IN SUBARACHNOID SPACE**



**CLINICAL**



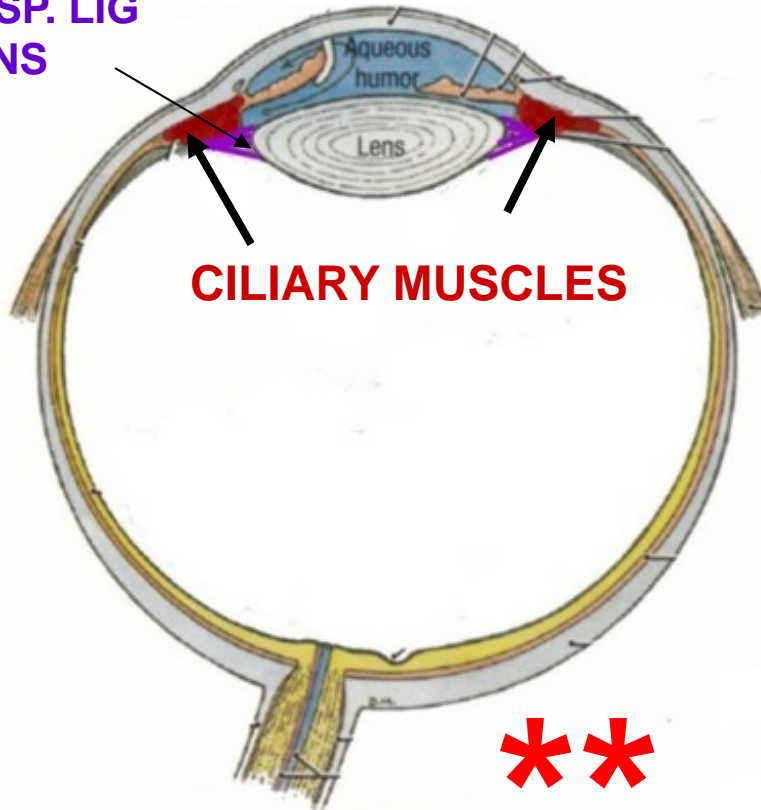
**DURA AND SUBARACHNOID SPACE (CSF) EXTEND AROUND OPTIC NERVE; INCREASE IN CSF (PRESSURE) CAN AFFECT VISION**

**PAPILLEDEMA = swelling of optic disc**

**Clinical - slow onset; headaches**

# EYE- STRUCTURE OF EYEBALL- VASCULAR LAYER

SUSP. LIG  
LENS

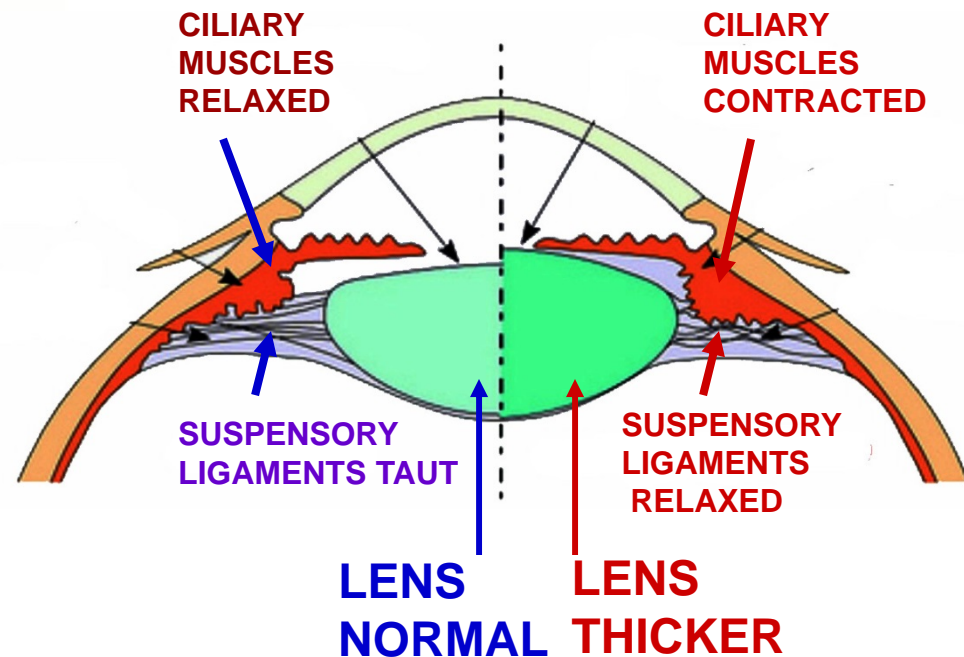


**CILIARY MUSCLES**

**B. CILIARY BODY- CILIARY MUSCLES- SMOOTH MUSCLES AT ATTACHMENTS OF SUSPENSORY LIGAMENTS OF LENS CONTROL THICKNESS OF LENS**

**NORMAL VISION**

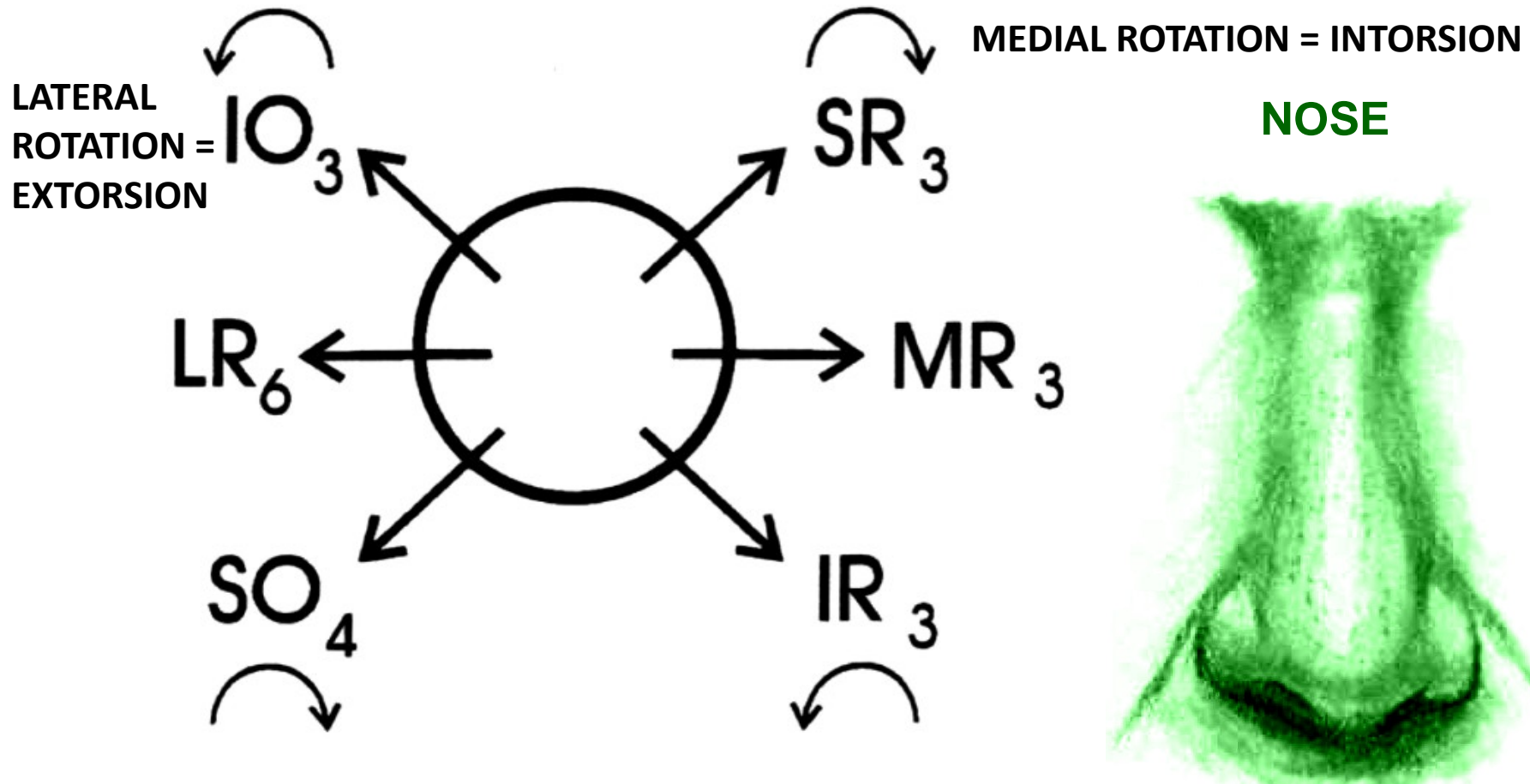
**NEAR VISION**



**ACCOMMODATION - THICKEN LENS FOR NEAR VISION (VIEWING OBJECTS CLOSE UP)**  
**PARASYMPATHETIC CONTROL- III (Short ciliary nerves)**

**CILIARY MUSCLES CONTRACT - LENS THICKER**

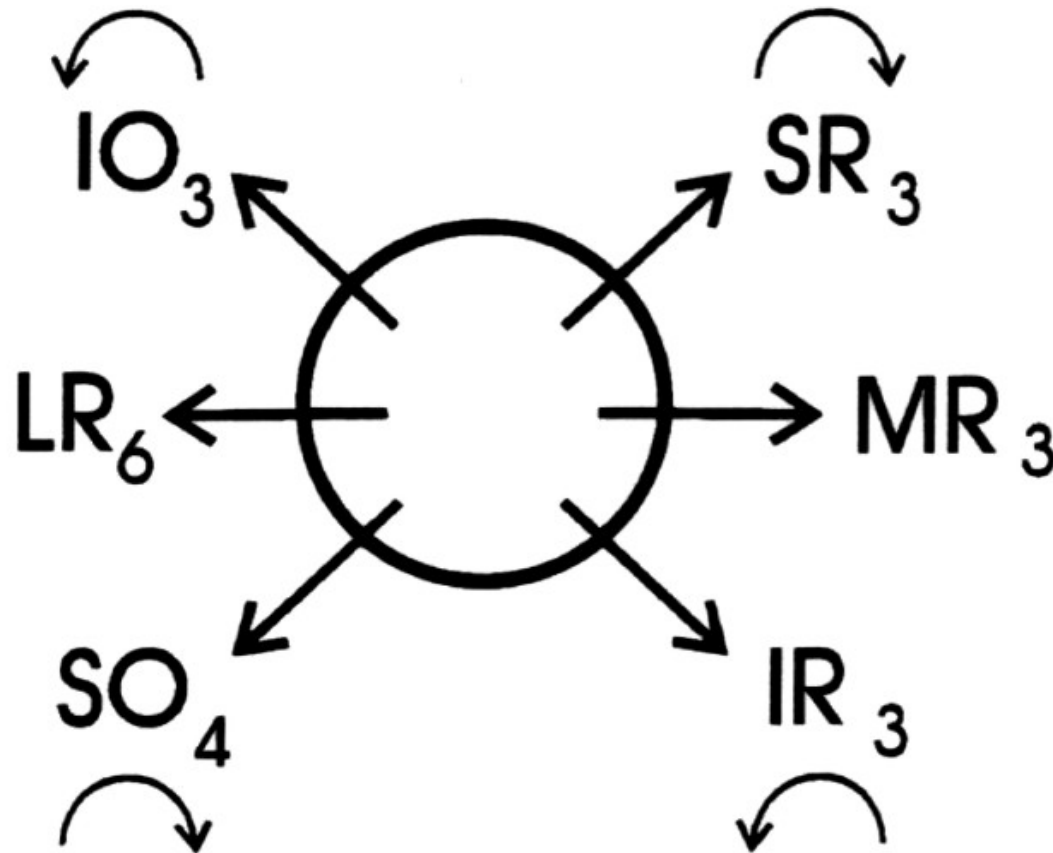
# EYE MOVEMENTS DIAGRAM



- 1- Resting position of eye depends upon tonic activities in muscles.
- 2- Damage to any one muscle does not entirely eliminate abduction, adduction, elevation or depression; only get weakness.



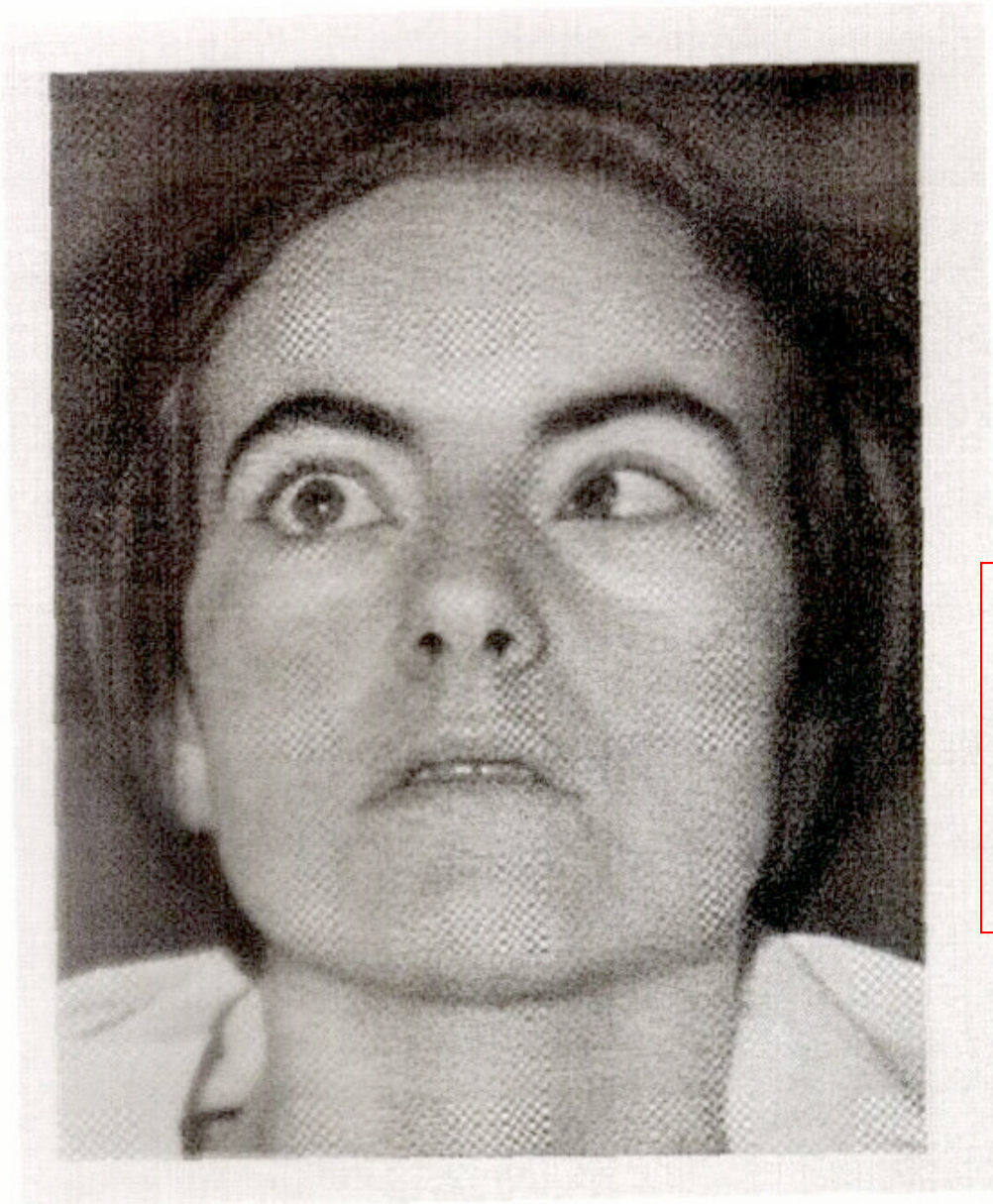
## EYE MOVEMENTS DIAGRAM



NOSE



- SAMPLE QUESTIONS: 1- WHAT ARE ACTIONS OF INFERIOR OBLIQUE?**  
**2- WHAT ARE ACTIONS OF SUPERIOR OBLIQUE?**  
**3. WHICH MUSCLES ROTATE EYE MEDIALY?**  
**2- WHAT IS SYMPTOM OF DAMAGE TO ABDUCENS NERVE?**



## ABDUCENS (VI) NERVE DAMAGE



**ABDUCENS (VI): AT REST 1)**  
**MEDIAL STRABISMUS**  
**(CROSS-EYED) DUE TO**  
**DAMAGE/PARALYZE**  
**LATERAL RECTUS**

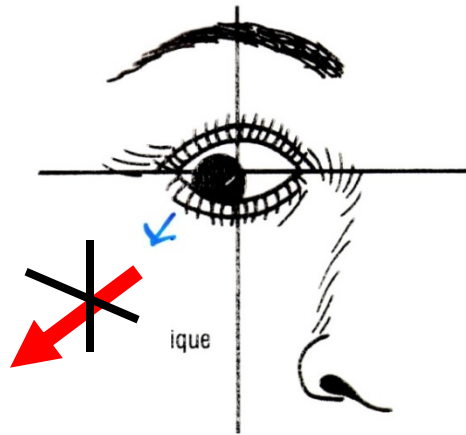
## PRACTICE QUESTION CLINICAL VIGNETTE



A 64 year-old female is in the back seat of car that suddenly decelerates in an accident. She shows no acute injury but in the following days **she begins having double vision. Examination of the patient shows that she is holding her head tilted** (see photo above). Cranial nerve examination finds that she has difficulty moving her right eye downward, particularly from an adducted position. A head MRI is ordered to specifically image which the following cranial nerves?

- A. right cranial nerve III
- B. left cranial nerve IV
- C. right cranial nerve IV
- D. left cranial nerve III
- E. right cranial nerve VI

# TROCHLEAR (IV) NERVE DAMAGE: INABILITY TO TURN EYE DOWN AND OUT; ALSO HEAD TILT



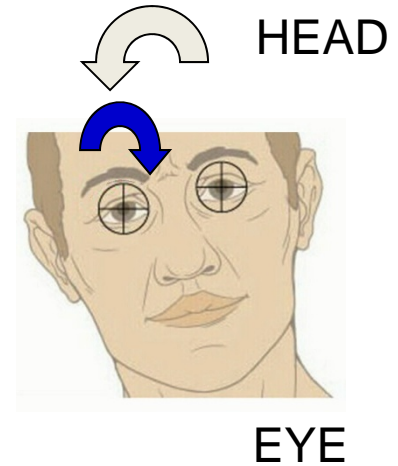
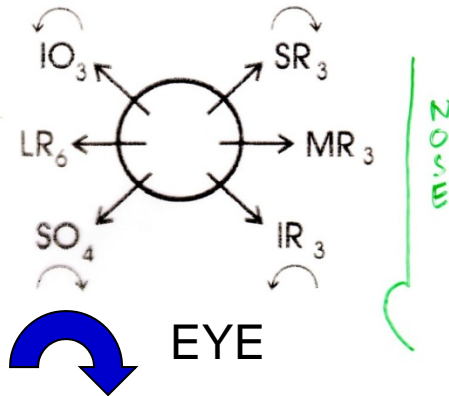
**PATIENT CANNOT LOOK DOWN AND OUT**

**Symptoms - Difficulty walking down stairs; HEAD TILTED**

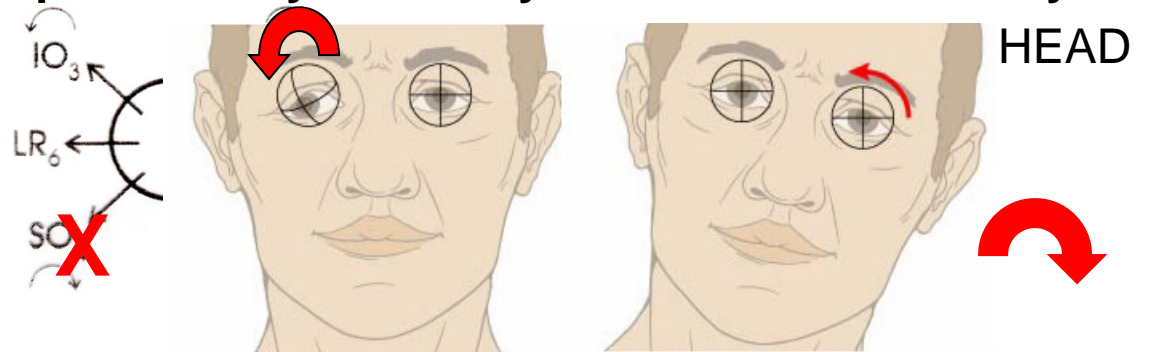
**\*\*\***

**AFTER IV DAMAGE - eye rotated laterally; PATIENT TILTS HEAD TO OPPOSITE SIDE so both eyes rotated**

NORMAL



**NORMAL Rotation** - occurs when tilt head; rotate ipsilateral eye medially when tilt head laterally



## PRACTICE QUESTION CLINICAL VIGNETTE



A patient sees a physician because the eyelid of her left eye is drooping and she is having double vision. Examination of the patient (photo above) shows **ptosis of the left eyelid and deviation of the left eye when the patient is told to look straight ahead. Further examination demonstrates that pupil is dilated in the left eye.**

## **PRACTICE QUESTION CLINICAL VIGNETTE**

Which of the following nerves is likely to have been damaged?

- A. Trochlear
- B. Abducens
- C. Oculomotor
- D. Facial
- E. Ophthalmic division of the Trigeminal (V1).



The ptosis is likely to be due to partial paralysis of which of the following muscles?

- A. Superior oblique
- B. Levator Palpebrae Superioris
- C. Frontalis
- D. Superior Rectus
- E. Orbicularis Oculi

The pupil is dilated because the action of the dilator pupillae muscle is unopposed. Which of the following is the innervation of the dilator pupillae muscle?

- A. Sympathetic fibers
- B. Facial nerve
- C. Infraorbital nerve (V2)
- D. Trochlear nerve
- E. Optic nerve

## OCULOMOTOR (III) NERVE DAMAGE



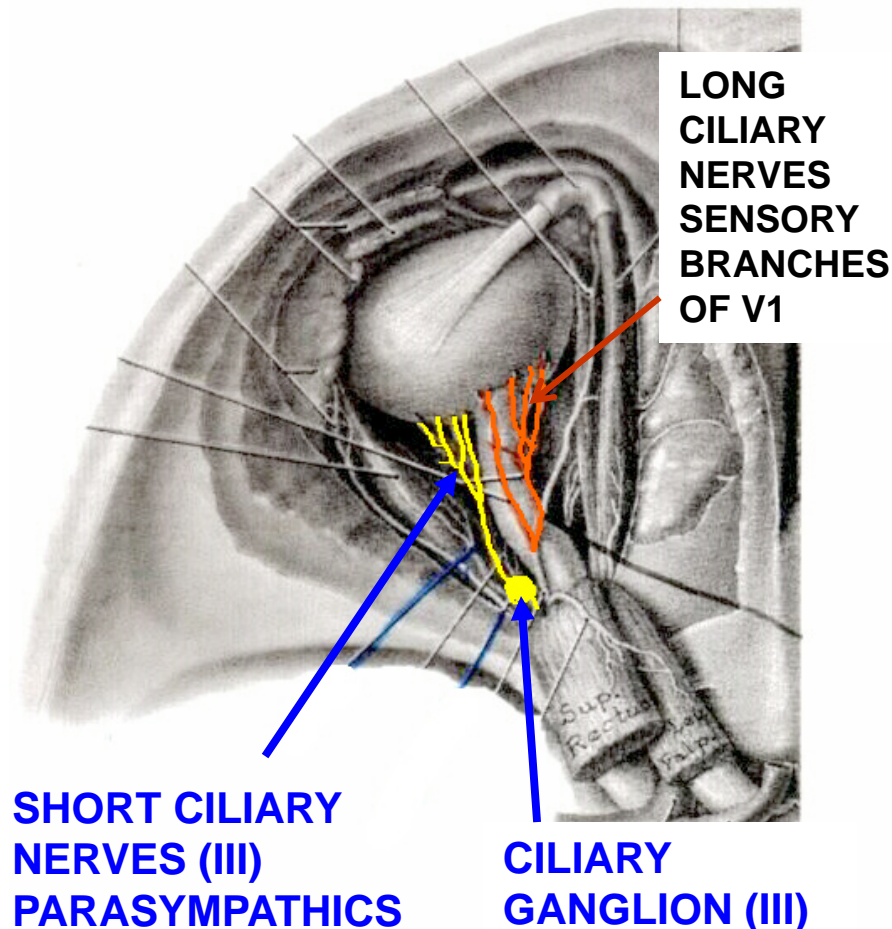
### AT REST

1) LATERAL STRABISMUS (WALL-EYED) DUE TO PARALYZE MEDIAL RECTUS

2) PTOSIS - DROOPING EYELID PARALYZE LEV. PALPEBRAE SUPERIORIS

3) DILATED PUPIL - (MYDRIASIS) PARALYZE PUPILLARY CONSTRICTOR

# CILIARY GANGLION - PARASYMPATHETIC



CILIARY GANGLION-  
PARASYMPATHETICS OF  
OCULOMOTOR N (III); TRAVEL IN  
SHORT CILIARY NERVES - (FOUND  
LATERAL AND DORSAL TO OPTIC  
NERVE)

**INNERVATE:** 1) CILIARY MUSCLES  
2) SPHINCTER (CONSTRICTOR)  
PUPILLAE

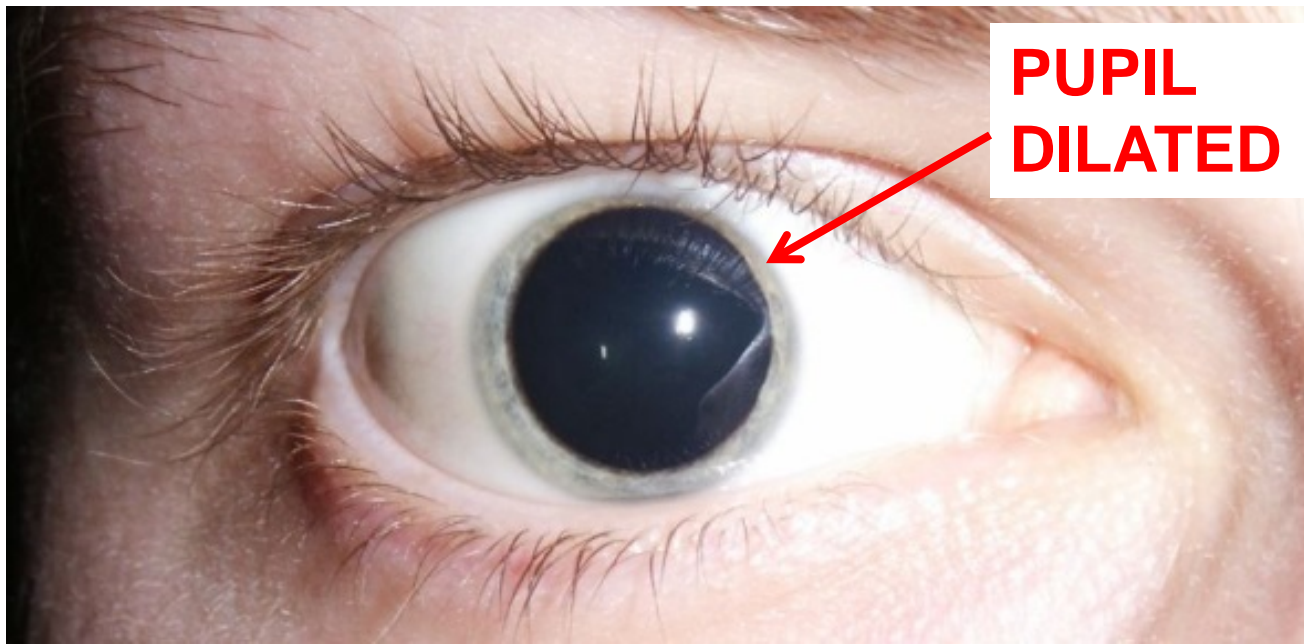
**NOTE:** LONG CILIARY NERVES  
BRANCHES OF V1 (OPHTHALMIC) -  
SENSORY TO CORNEA - (FOUND  
MEDIAL AND DORSAL TO OPTIC  
NERVE)

**CLINICAL \*\***

**DAMAGE SHORT CILIARY NERVES (ONLY) - MAIN  
SYMPTOM: PUPIL IS DILATED = MYDRIASIS**



# 'BLOWN PUPIL' = MYDRIASIS (muh-dry'-a-sis)



**'BLOWN PUPIL' = MYDRIASIS - PUPIL DILATED, UNABLE TO CONSTRICT IN RESPONSE TO LIGHT - INDICATES CATASTROPHE - STROKE, HERNIATION, ETC.**

**Note; Anisocoria – pupils of unequal size (normal or abnormal)**