
بسم الله الرحمن الرحيم

GROSS ANATOMY OF
THE TROCHLEAR NERVE

By

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THE TROCHLEAR NERVE (CN IV)

- The trochlear nerve is the fourth paired cranial nerve. It is the smallest cranial nerve (by number of axons), yet has the longest intracranial course. It has a purely somatic motor function.

Introduction

- Trochlear nerve has only somatic motor component.

Somatic motor (general somatic efferent)	Somatic motor innervates the superior oblique muscle of the contralateral orbit.

Anatomy

- Nucleus.
- Intracranial course
- Extracranial course

Segments of the trochlear nerve

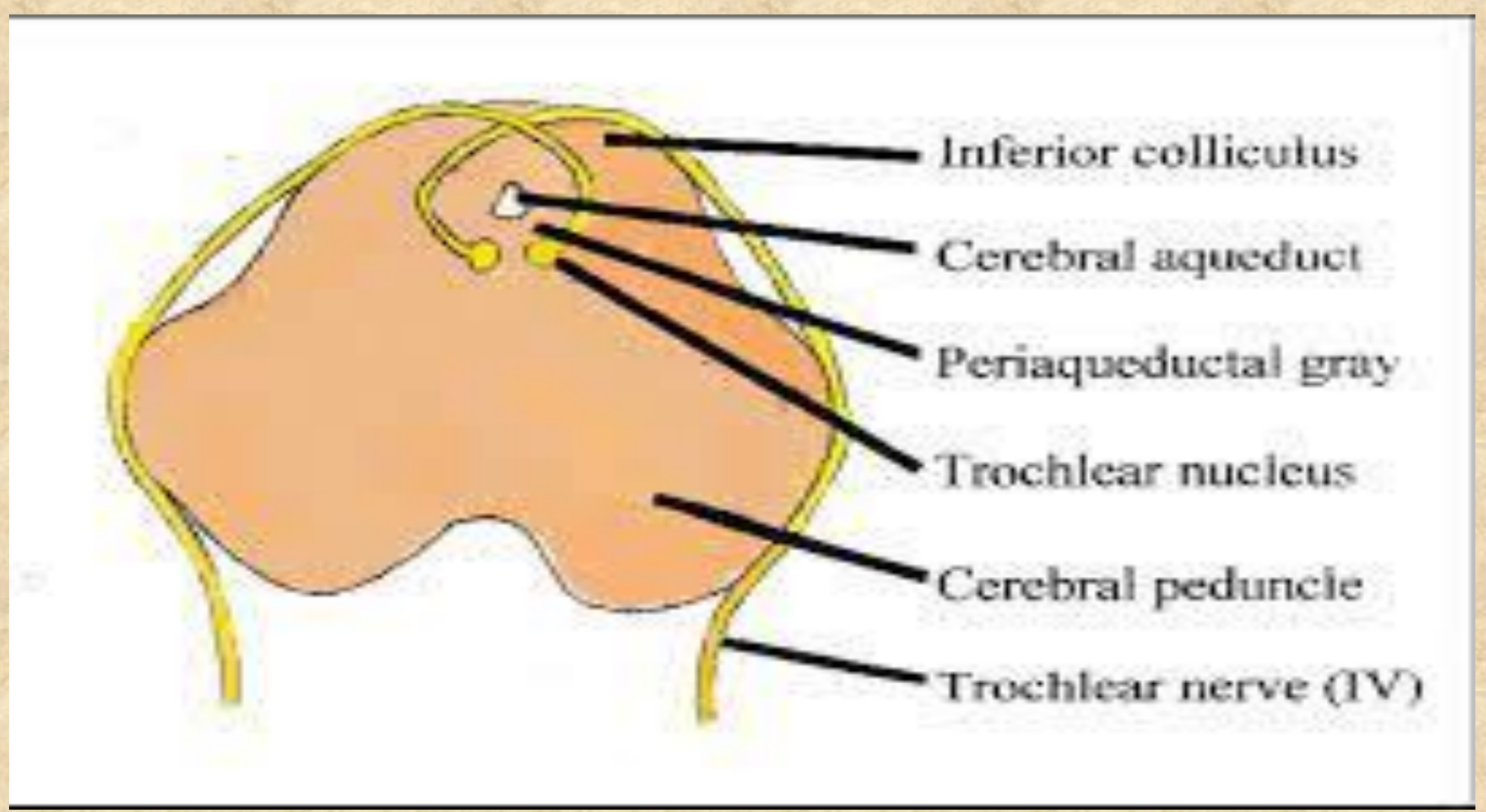
- Central,
- Cisternal,
- Cavernous, &
- Orbital

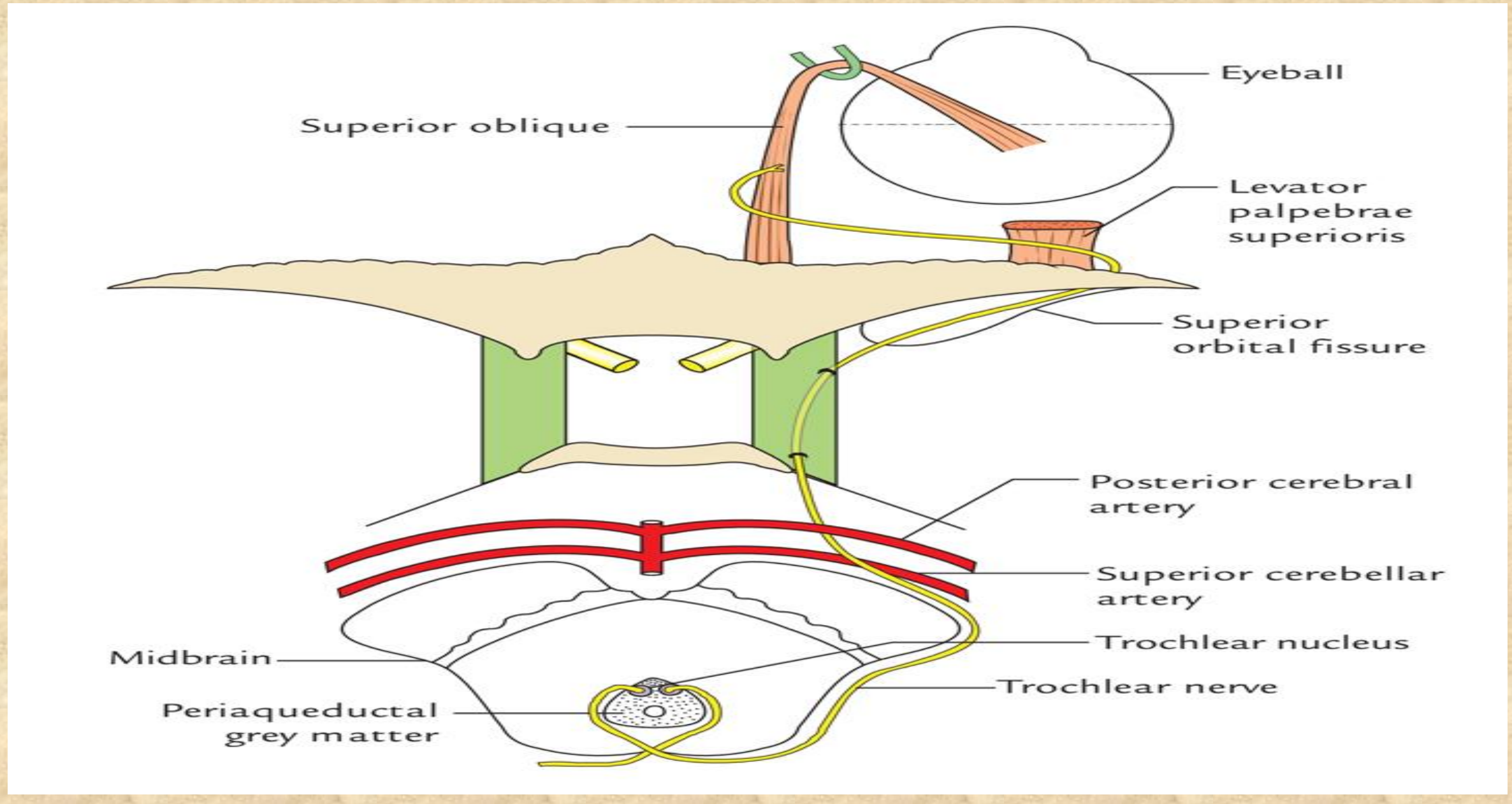
Trochlear nucleus

- Trochlear nucleus is located in tegmentum of midbrain, at the level of inferior colliculus.
- It is located ventral to the periaqueductal grey matter, inferior to the oculomotor nucleus & superior to the medial longitudinal bundle.

ANATOMICAL COURSE

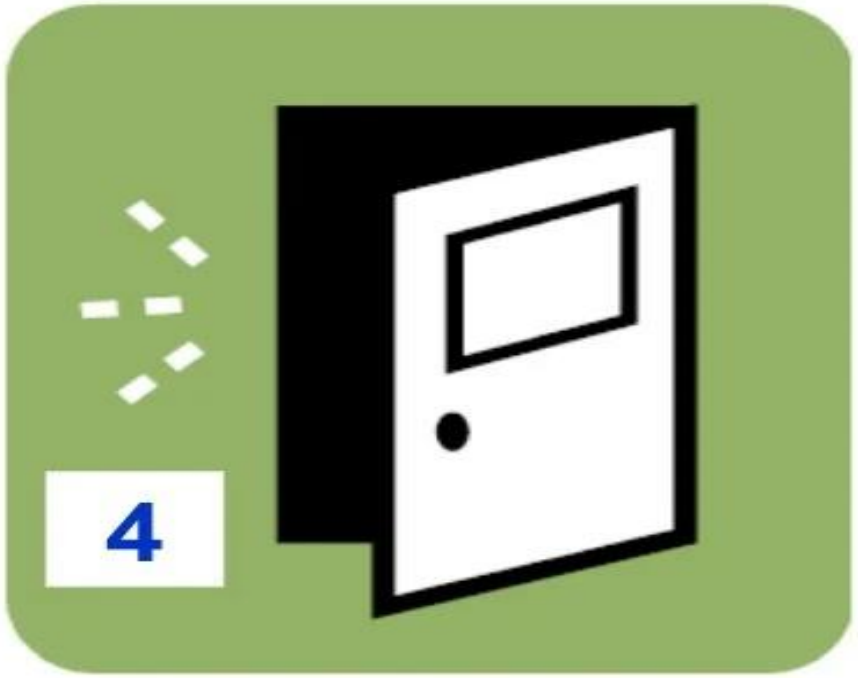
- The trochlear nerve arises from the **trochlear nucleus** of the brain, emerging from the posterior aspect of the midbrain (it is the only cranial nerve to exit from the posterior midbrain).
- It runs anteriorly and inferiorly within the **subarachnoid space** before piercing the dura mater adjacent to the **posterior clinoid process** of the sphenoid bone.
- The nerve then moves along the lateral wall of the **cavernous sinus** (along with the oculomotor nerve, the abducent nerve, the ophthalmic and maxillary branches of the trigeminal nerve and the internal carotid artery) before entering the orbit of the eye via the **superior orbital fissure**.


Inferior colliculus
Cerebral aqueduct
Periaqueductal gray
Trochlear nucleus
Cerebral peduncle
Trochlear nerve (IV)


Eyeball
Superior oblique
Levator palpebrae superioris
Superior orbital fissure
Posterior cerebral artery
Superior cerebellar artery
Trochlear nucleus
Midbrain
Trochlear nerve
Periaqueductal grey matter

Central segment

- Course posteriorly & caudally surrounding the aqueduct of sylvius.
- Nerves decussate at anterior medullary velum in the roof of aqueduct before exiting from dorsal aspect of midbrain below the inferior colliculus.



Cisternal segment

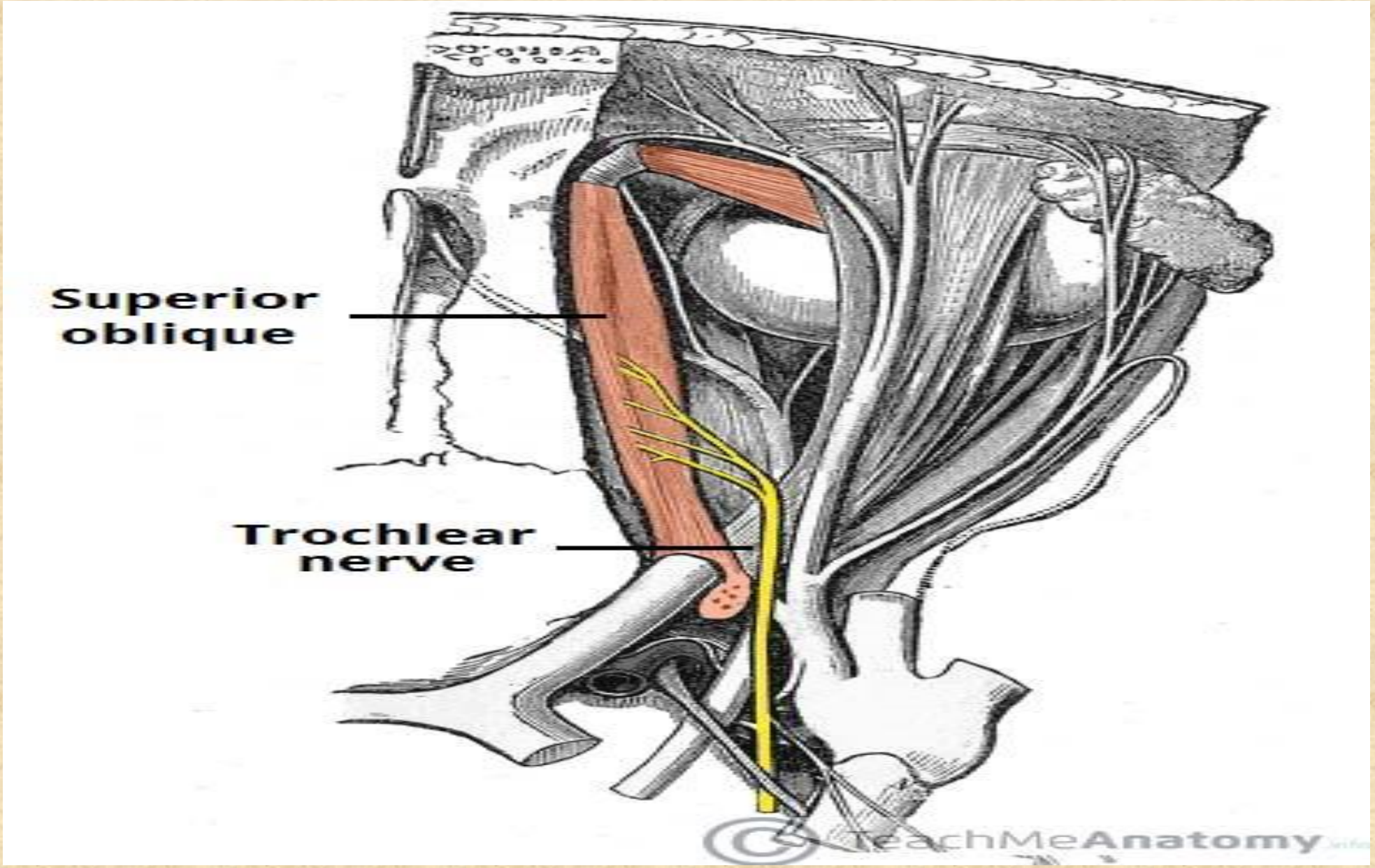
Course through the ambient cistern between the posterior cerebral & superior cerebellar arteries.

Cavernous segment

- The cavernous segment of the trochlear nerve course through the lateral wall of the cavernous sinus below the oculomotor nerve.

Orbital segment

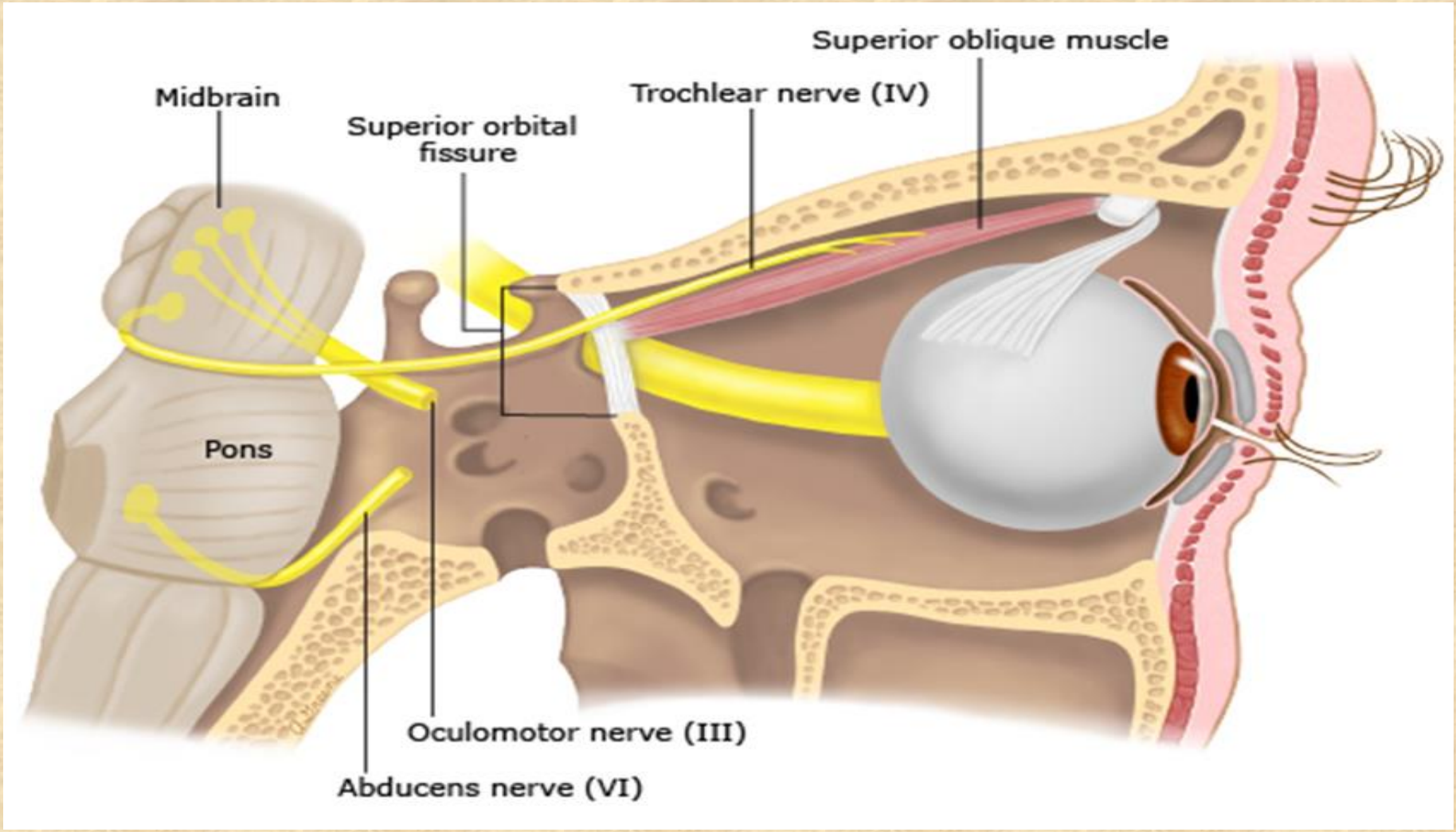
- The trochlear nerve enters the orbit through the superior orbital fissure outside the annular ring of Zinn.
- The orbital segment of the trochlear nerve crosses medially over levator palpebrae superioris and superior rectus muscles before entering the belly of superior oblique muscle



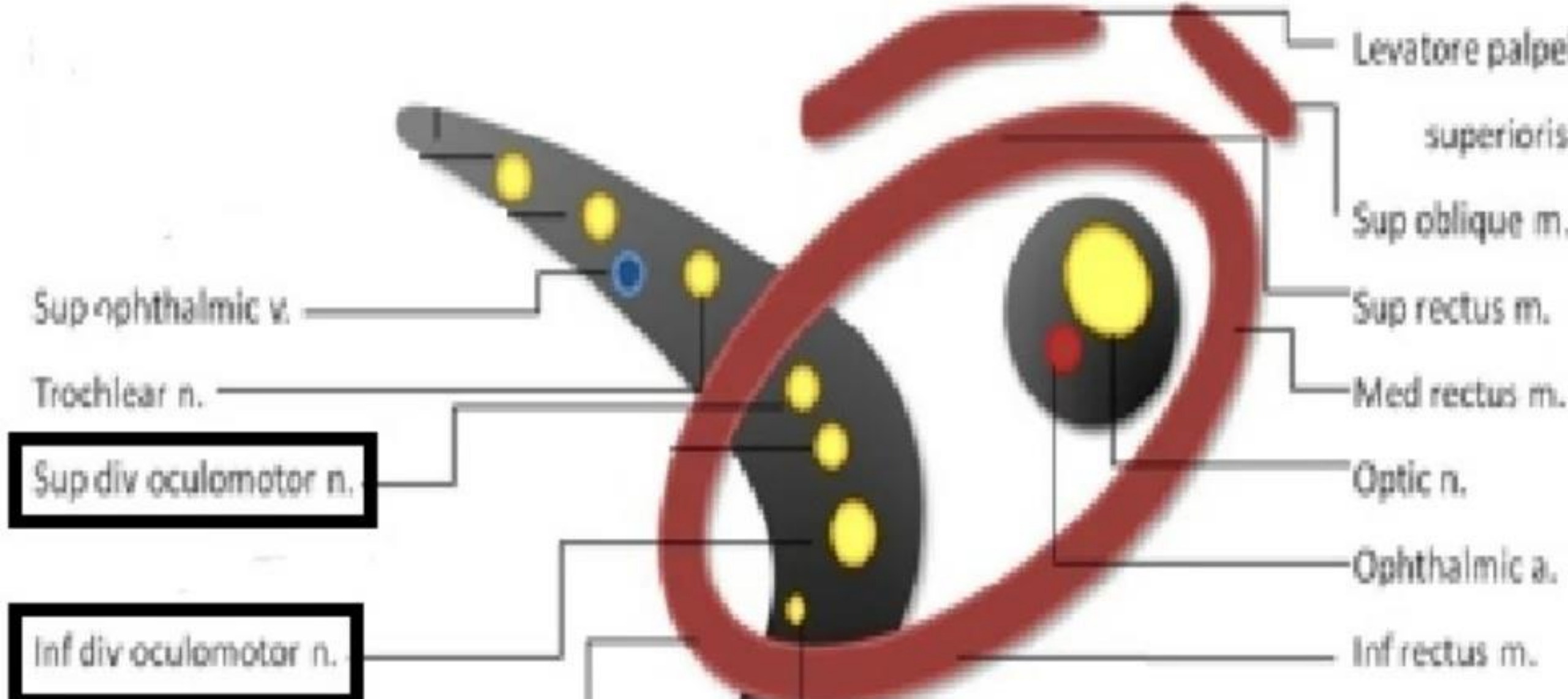
THE TROCHLEAR NERVE AND SUPERIOR OBLIQUE MUSCLE

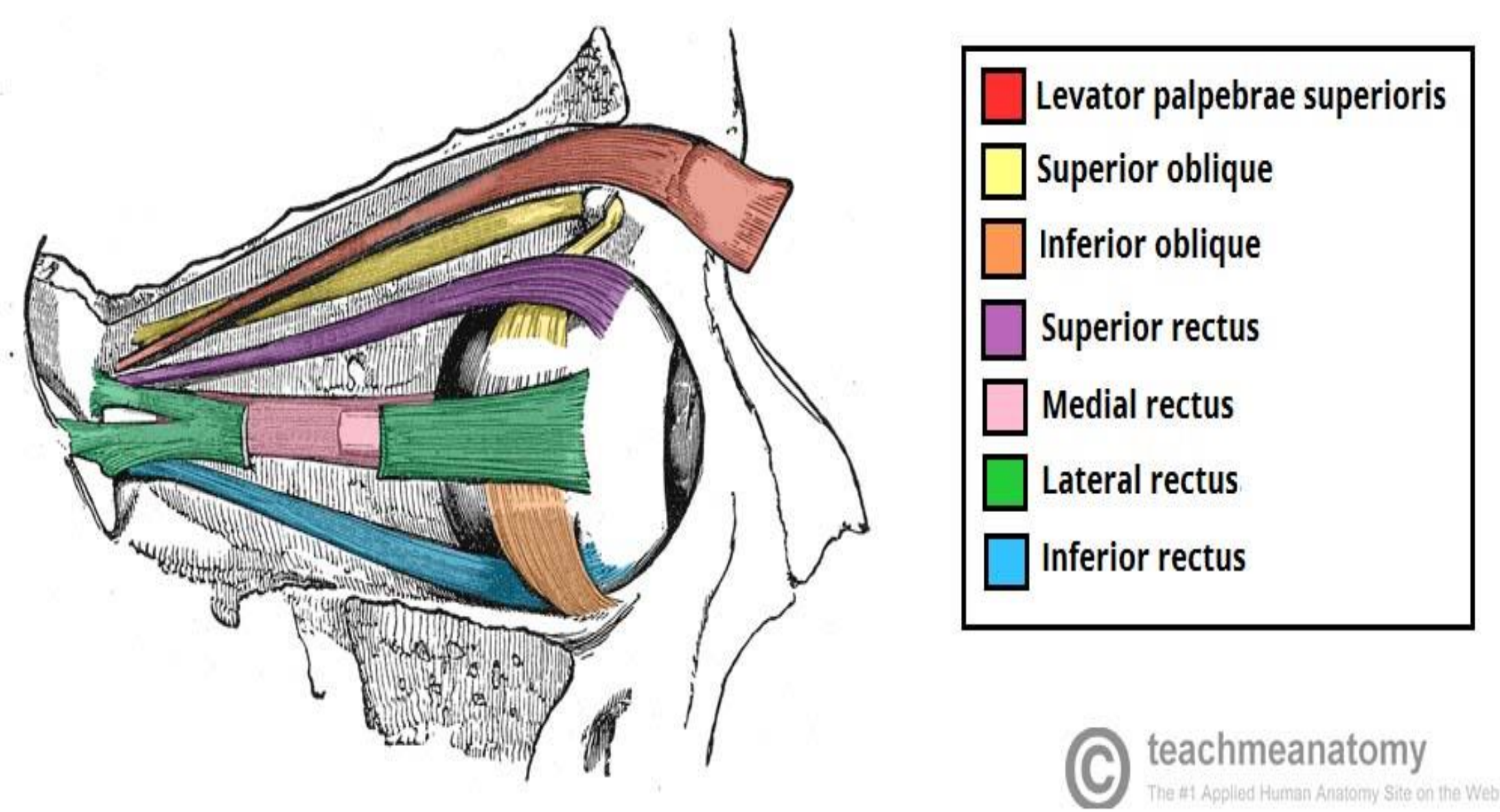
MOTOR FUNCTION

- The trochlear nerve innervates a single muscle – the **superior oblique**, which is a muscle of oculomotion. As the fibers from the trochlear nucleus cross in the midbrain before they exit, the trochlear neurons innervate the **contralateral** superior oblique.
- The tendon of the superior oblique is tethered by a fibrous structure known as the **trochlea**, giving the nerve its name. Although the mechanism of action of the superior oblique is complex, in clinical practice it is sufficient to understand that the overall action of the superior oblique is to depress and intort the eyeball.


Superior oblique muscle
Midbrain
Trochlear nerve (IV)
Superior orbital fissure
Pons
Oculomotor nerve (III)
Abducens nerve (VI)

Superior orbital fissure & annular ring of Zi





LATERAL VIEW OF THE EXTRAOCULAR MUSCLES.

SUMMARY OF TROCHLEAR NERVE	
EMBRYOLOGY	The somatic efferent column in the inferior midbrain
NUCLEUS	Inferior to oculomotor (CN III) nucleus Within the periaqueductal grey matter Embedded in the medial longitudinal fasciculus
INTRAPARENCHYMAL PART	Oblique course through the periaqueductal grey matter Travels around the peripheral boundary of periaqueductal grey matter Decussates beneath the superior medullary velum Emerges from the posterior surface of the brainstem below the inferior colliculus
CISTERNAL PART	Enters quadrigeminal cistern Wraps around crus cerebri Ascends as it travels anteriorly Pierces the dura mater to enter the cavernous sinus
CAVERNOUS PART	The lateral wall of the cavernous sinus Inferior to oculomotor nerve (CN III) and superior to ophthalmic branch of the trigeminal nerve (CN V1) Exits skull through superior orbital fissure
INTRAORBITAL PART	Travels lateral to common tendinous ring Superior to oculomotor nerve (CN III)
TARGET MUSCLE	Superior oblique muscle
FUNCTION	Inward rotation of the eye Depression of eye Abduction of eye

CLINICAL RELEVANCE

EXAMINATION OF THE TROCHLEAR NERVE

- The trochlear nerve is examined in conjunction with the oculomotor and abducent nerves by testing the movements of the eye.
- The patient is asked to follow a point (commonly the tip of a pen) with their eyes without moving their head. The target is moved in an ‘H-shape’ and the patient is asked to report any blurring of vision or **diplopia** (double vision).

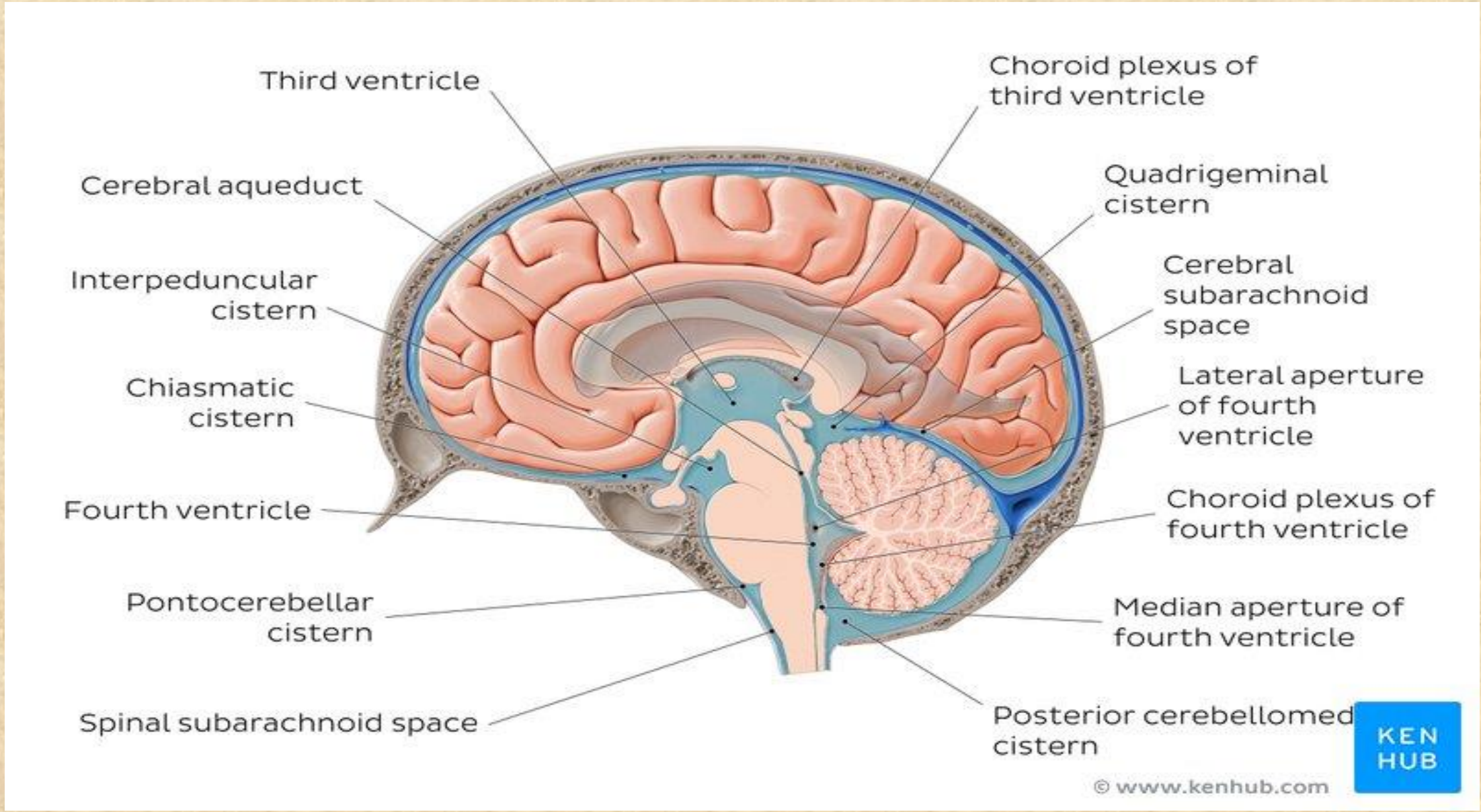
CLINICAL RELEVANCE

PALSY OF THE TROCHLEAR NERVE

- Trochlear nerve palsy commonly presents with **vertical diplopia**, exacerbated when looking downwards and inwards (such as when reading or walking down the stairs). Patients can also develop a head tilt away from the affected side.
- They are commonly caused by **microvascular damage** from diabetes mellitus or hypertensive disease. Other causes include congenital malformation, thrombophlebitis of the cavernous sinus, and raised intracranial pressure.

KEY FACTS	
TYPE	General somatic efferent (GSE)
TARGET MUSCLE	Trochlear nerve (CN IV) to the superior oblique muscle Abducens nerve (CN VI) to the lateral rectus muscle
EXTRAOCULAR MUSCLES	Four rectus muscles: lateral, medial, superior, and inferior Two oblique muscles: inferior and superior
MEDIAL LONGITUDINAL FASCICULUS	Relay axons between the oculomotor (CN III), trochlear (CN IV), and the abducens (CN VI) nerves
LOCATION OF NUCLEI	Trochlear nerve (CN IV) – Level of the inferior colliculus Abducens nerve (CN VI) – Dorsal pons, the floor of 4th ventricle
PARTS OF NERVE	Nucleus Intraparenchymal Cisternal Cavernous Intraocular
DISORDERS OF THE TROCHLEAR NERVE (CN IV)	Torsional and Vertical Diplopia Fourth Nerve Palsy (Acute & Chronic) Nuclear Lesions
DISORDERS OF THE ABDUCENS NERVE (CN VI)	Esotropia & Diplopia Wernicke-Korsakoff and Tolusa-Hunt Syndromes Nuclear and Supranuclear Lesions
MNEMONIC FOR INNERVATION OF EXTRAOCULAR MUSCLES	SO4 – Superior oblique by CN IV LR6 – Lateral rectus by CN VI AO3 – All others by CN III

SUBARACHNOID CISTERNS (OVERVIEW)



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