Oculomotor nerve

- Endoscopic 360° vision of the orbit: A comparative anatomical study of endonasal and transorbital approaches
- Unified Framework for Oculomotor Nerve Reconstruction: Tractography-Based Anatomical Assessment
- Usefulness of piezoelectric sensor device for monitoring extraocular movement during endoscopic endonasal surgery to remove skull base tumor
- Isolated third cranial nerve palsy as the presenting sign of tuberculum sellae meningioma: a case report
- A case report with a literature review of trigeminal neuralgia secondary to a large posterior communicating artery aneurysm
- Idiopathic cerebellar hemorrhage in a patient with isolated developmental venous anomaly: A case report
- Surgical resection of A giant ventral pontine cavernous malformation: Two-dimensional video
- Pediatric isolated oculomotor nerve palsy induced by peduncular atypical teratoid/rhabdoid tumor: case report and literature review

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The oculomotor nerve (cranial nerve III) is a motor nerve that innervates most of the extraocular muscles and carries parasympathetic fibers to the eye.

Trajectory

1. Nuclear Segment (Midbrain)

- Originates in the midbrain at the level of the superior colliculus.
- Nuclei:
  - Oculomotor nucleus: motor control of extraocular muscles and eyelid elevation.
  - Edinger–Westphal nucleus: preganglionic parasympathetic fibers to the eye.

2. Fascicular Segment (Midbrain Parenchyma)

- Fibers pass ventrally through:
  - Red nucleus
  - Medial longitudinal fasciculus (MLF)
  - Substantia nigra
- Exits the midbrain in the interpeduncular fossa.

3. Cisternal Segment (Subarachnoid Space)

- Courses through the interpeduncular cistern.
- Passes between:
  - Posterior cerebral artery (PCA) – superior
  - Superior cerebellar artery (SCA) – inferior

- Vulnerable to compression by aneurysms of the posterior communicating artery (PComA).
- Pierces the dura to enter the lateral wall of the cavernous sinus.

4. Cavernous Sinus and Orbital Segment

- In the lateral wall of the cavernous sinus:
  - Superior to the trochlear nerve (CN IV) and ophthalmic nerve (V1).
  - Lateral to the internal carotid artery.
- Divides into:
  - **Superior division**: to superior rectus and levator palpebrae superioris.
  - **Inferior division**: to medial rectus, inferior rectus, inferior oblique.
    - Parasympathetic fibers continue to the ciliary ganglion → short ciliary nerves → sphincter pupillae and ciliary muscle.

Summary

Segment	Key Structures Traversed
Nuclear	Oculomotor and Edinger–Westphal nuclei in the midbrain
Fascicular	Red nucleus, MLF, substantia nigra
Cisternal	Interpeduncular fossa; between PCA and SCA; near PComA
Cavernous-Orbital	Cavernous sinus lateral wall; enters orbit via superior orbital fissure

. It enters the orbit via the superior orbital fissure and controls most of the eye's movements, including constriction of the pupil and maintaining an open eyelid by innervating the levator palpebrae superioris muscle. The oculomotor nerve is derived from the basal plate of the embryonic midbrain. Cranial nerves IV and VI also participate in control of eye movement.

The third cranial nerve travels through the superior, lateral aspect of the cavernous sinus, at approximately the same horizontal level as the pituitary gland [1)].

Blood supply

27 oculomotor nerves were examined after injection of India ink or methylmethacrylate into the vertebral and the internal carotid arteries. The ventral surface of the cisternal segment of the nerve was noted to be in close relationship with the superior cerebellar artery (96.3%) and its pontine (37.0%), mesencephalic (25.9%) and perforating branches (81.5%); the posterolateral pontine artery (70.4%) and its branches; the anterolateral pontine branches (29.6%), and the perforating branches (85.2%) of the basilar artery; the mesencephalic perforating arteries (11.1%) and their peduncular branches (62.9%); the peduncular branches of the diencephalic perforators (11.1%) and the P1 segment (18.5%); and the accessory collicular artery (3.7%). The dorsal surface of the nerve was in close relationships to the P1 and P2A segments (100%) of the posterior cerebral artery and their peduncular branches (22.2%); the posterior communicating artery (100%); the collicular (100%) and the accessory collicular artery (33.3%), and their peduncular (51.8%) or the perforating branches (22.2%); the medial posterior choroidal artery (25.9%) and its branches (11.1%); and the mesencephalic and diencephalic perforating arteries (100%). Vascular penetration was noted in 51.8% of the third nerves. The most common penetrating vessel was the collicular artery (18.5%) and its branches (22.2%). The cisternal segment of the oculomotor nerve was most often supplied by the mesencephalic perforators (88.9%) [2)].

Pathology

Oculomotor nerve palsy or third nerve palsy

1)
Parkinson D. Surgical anatomy of the cavernous sinus. In: Wilkins RH, Rengachary SS, editors. Neurosurgery. New York: Mc Graw Hill; 1985. pp. 1478–1483.
2)
Marinković S, Gibo H. The neurovascular relationships and the blood supply of the oculomotor nerve: the microsurgical anatomy of its cisternal segment. Surg Neurol. 1994 Dec;42(6):505-16. Review. PubMed PMID: 7825106.