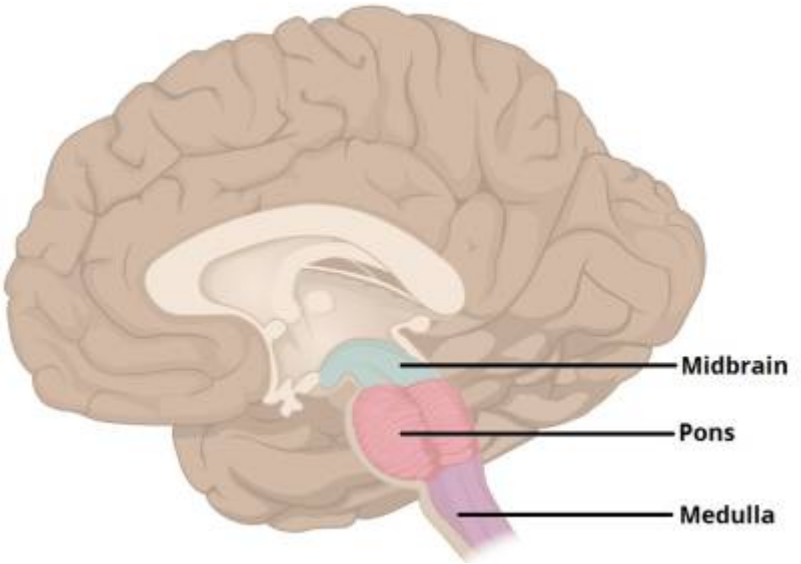
Midbrain



The midbrain, pons, and medulla oblongata differ in their macro-, micro-, and functional anatomy, in both their pathoclisis (preferential vulnerability to pathological processes) and topographic anatomical relations. Differing pathoclisis results in a different incidence and distribution of histotypes in each of the three segments (e.g., low-grade tumors are much more common in the midbrain than in the pons). Histotype and anatomical relations of a target lesion dramatically affect the difficulty of surgery. For example, a pons glioma poses completely different surgical challenges from those of a midbrain glioma, and a midbrain glioma in turn poses completely different challenges from those of a midbrain cavernoma. In short, the topography and histopathology of the target lesion are crucial criteria for surgical decision-making. Thus, they are also crucial for identifying homogeneous patients' subgroups within the larger population of patients harboring brainstem lesions. In light of these considerations, neurosurgical reporting and debate about brainstem surgery should be standardized according to topography and histopathology [1)]

The top part of the brainstem that connects the brain to the spinal cord.

The midbrain or mesencephalon (from the Greek mesos, middle, and enkephalos, brain is a portion of the central nervous system associated with vision, hearing, motor control, sleep/wake, arousal (alertness), and temperature regulation.

The midbrain comprises the tectum (or corpora quadrigemina), tegmentum, the cerebral aqueduct (or ventricular mesocoelia or "iter"), and the cerebral peduncles, as well as several nuclei and fasciculi. Caudally the midbrain adjoins the metencephalon (afterbrain) (pons and cerebellum) while rostrally it adjoins the diencephalon (thalamus, hypothalamus, etc.). The midbrain is located below the cerebral cortex, and above the hindbrain placing it near the center of the brain.

Specifically, the midbrain consists of:

Tectum

Inferior colliculus

Superior colliculus

Cerebral peduncle

Midbrain tegmentum

Crus cerebri

Substantia nigra.

Dopaminergic neurons of the midbrain are the main source of dopamine (DA) in the mammalian central nervous system.

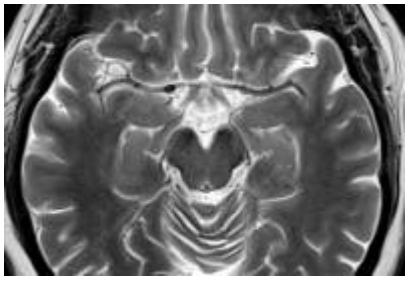
Pathology

Midbrain hemorrhage

Midbrain tumors

Midbrain cavernous malformation.

Midbrain MRI



In a prospective longitudinal design, Hirad et al. demonstrated there are reductions in midbrain white matter integrity due to a single season of collegiate football, and that the amount of reduction in midbrain white matter integrity is related to the amount of rotational acceleration to which players' brains are exposed. We then replicate the observation of reduced midbrain white matter integrity in a retrospective cohort of individuals with frank concussion, and further show that variance in white matter integrity is correlated with levels of serum-based tau, a marker of blood-brain barrier disruption. These findings mean that noninvasive structural MRI of the midbrain is a succinct index of both clinically silent white matter injury as well as frank concussion [2].

1)

Serra C, Türe H, Fırat Z, Staartjes VE, Yaltırık CK, Ekinci G, Sav A, Türe U. Microsurgical management of midbrain gliomas: surgical results and long-term outcome in a large, single-surgeon, consecutive series. J Neurosurg. 2023 Jul 21:1-12. doi: 10.3171/2023.5.JNS222219. Epub ahead of print. PMID: 37503951.

2)

Hirad AA, Bazarian JJ, Merchant-Borna K, Garcea FE, Heilbronner S, Paul D, Hintz EB, van Wijngaarden

E, Schifitto G, Wright DW, Espinoza TR, Mahon BZ. A common neural signature of brain injury in concussion and subconcussion. Sci Adv. 2019 Aug 7;5(8):eaau3460. doi: 10.1126/sciadv.aau3460. eCollection 2019 Aug. PubMed PMID: 31457074; PubMed Central PMCID: PMC6685720.