Cavernous sinus pathology: CT and MRI findings

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Learning objectives

Learning Objectives: To recognize the complex anatomy of the cavernous sinus. To illustrate CT and MRI findings of cavernous sinus lesions.

Background

Background: The cavernous sinus is a venous system component of endocranium, including a large group of thin-walled veins that form a cavity bounded by the sphenoid, located laterally to the sella and temporal bone of the skull. A wide spectrum of neoplastic, inflammatory, infectious or vascular processes may affect it. Features with CT, angio-CT, MRI and angio-MRI play an important role in the diagnosis of these lesions.

We describe and illustrate the most common radiological patterns of lesions that could compromise this compartment.

Imaging findings OR Procedure details

Imaging Findings:

CT and MRI scans can identify primary tumors and depict the spread of non-neoplastic processes which may affect the cavernous sinus. These entities include neoplasms (e.g., meningiomas, schwannomas, invasive pituitary adenomas, lymphomas or metastases), inflammatory and infectious diseases (e.g., pituitary abscess, thrombophlebitis or Tolosa-Hunt syndrome), and vascular lesions (e.g., aneurysm or carotid-cavernous fistula).

Schwannoma

Although vestibular schwannomas represent about 95% of intracranial schwannomas, neural sheath tumors can develop in all the other nerves of the cerebellopontine angle, especially trigeminal and facial nerves but also IX to XII nerves. Neuroimaging features are the same as for vestibular schwannomas, including possible cystic or hemorrhagic components.

Trigeminal schwannomas represent about 0.2% of all intracranial tumors and about 2%-3% of all intracranial schwannomas, and they may arise in any segment of the nerve; however, the majority develops at the gasserian ganglion. They may grow primarily in the parasellar region or extend posteriorly through the porus trigeminus.
into the posterior fossa. Tumor extension into the pterygoid fossa or paranasal sinuses occurs in 10% of cases. The pressure exerted by the tumor leads to erosion of the underlying bone and enlargement of the foramen ovale, foramen rotundum, or the superior orbital fissure, which is better appreciated on thin-section coronal-CT scans. Trigeminal schwannomas typically follow the course of the fifth cranial nerve and have a dumbbell-shaped configuration. They are smoothly marginated tumors and are usually isointense compared to gray matter on T1WI and hyperintense on T2WI. Small tumors are homogeneous; large tumors can have heterogeneous signal intensity due to degenerative changes, including cyst formation and fatty degeneration.

**Meningioma**

Meningiomas became up to 18% of all intracranial tumors. They may arise from a suprasellar or parasellar location. Suprasellar meningiomas commonly arise from the diaphragm sellae or tuberculum sellae, and vision defects caused by compression of the optic chiasm are common clinical findings.

Large meningiomas originating along the planum sphenoidale or greater wing of the sphenoid bone may extend into the suprasellar cistern or parasellar regions. These tumors may be entirely parasellar if they originate from the dural wall of the cavernous sinus.

Meningiomas are generally isointense relative to cortical gray matter on T1- and T2-weighted images.

**Chondroma and Chondrosarcoma**

Chondromatous tumors develop from embryonic cartilaginous remnants enclosed in the bones of the skull base. They often arise from the petrooccipital or sphenoorbital synchondrosis and destroy the adjacent bones. Chondromatous tumors can be hypoattenuating at CT, possibly with a marginal high-attenuation area due to a dense matrix of hyaline cartilage or massive calcification. Lytic bone erosion may be seen.

At MR imaging, the tumor is hypointense on T1-weighted images and heterogeneously hyperintense on T2-weighted images; it enhances poorly due to its hypovascularity.

**Lymphoma**

Lymphomas appear as isoattenuating or hyperattenuating homogeneous masses on CT scans with intense enhancement after contrast agent administration. At MRI, lymphomas of the sellar region have non-specific imaging features; they are hypointense on T1-
weighted images and hyperintense on T2-weighted images and enhance after contrast agent injection. Nevertheless, mass effect and edema are also present.

Aneurysms

The diagnosis of aneurysms is critically important in a sellar region evaluation. The arteries in the Willis´ polygon, which surrounds the sella turcica, are the most frequent locations of intracranial aneurysms. A round lesion with an internal signal void on spin-echo MRI, especially on those acquired with T2WI is a classic feature of an aneurysm with rapid internal blood flow. However, partially thrombosed aneurysms appear as well-demarcated round parasellar or intrasellar lesions with internal T1WI hyperintensity and characteristic heterogeneous T2WI hypointensity, findings that indicate intraaneurysmal clotting. Because a giant aneurysm with partial internal clotting may mimic a solid destructive tumor of the skull base, MR angiography or conventional angiography should be performed in cases with these features before biopsy is considered. The finding of a residual patent lumen on images helps confirm the diagnosis of aneurysm.

Images for this section:
Fig. 1: Schwannoma of the trigeminal nerve
Fig. 2: Plexiform neurinoma

Fig. 3: Neurinoma of the trigeminal nerve (T1-weighted sequences and T2)
Fig. 4: Meningioma of the tuberculum sellae CT without and with contrast
Fig. 5: Neurinoma of the Meckel’s cave

Fig. 6: Chondroma
Fig. 7: Right posterior communicating artery aneurysm digital angiography and MR.
Conclusion

Imaging studies are essential for the evaluation of the tumors and non-neoplastic processes affecting the cavernous sinus. MRI has become the dominant modality as it allows a multiplanar approach and direct visualization of the lesions and surrounding structures involvement.

Personal Information

References


