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Key imaging characteristics for preoperative identification of cavernous sinus hemangioma

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Cavernous sinus hemangiomas are relatively rare but have characteristic imaging features. We present a case of a large extra-axial middle cranial fossa mass arising from the cavernous sinus in a 51-year-old female, and we describe the unique features and complications of this intracranial tumor. With the proper pre-operative diagnosis, an appropriate plan can be created for these highly vascular lesions, minimizing the risks involved with surgery.

Introduction

Cavernous sinus hemangiomas (CSHs) are vascular malformations consisting of abnormal, dilated vessels without intervening neural tissue (1). They constitute 2-3% of all lesions in the cavernous sinus (2).

Pathologically, these tumors are highly vascular and contain "honeycombed vascular spaces" with stagnant blood flow (3). This vascularity and proximity to neurovascular structures complicates surgical procedures, with resulting morbidity and mortality of 36 to 38% (3). Extra-axial CH tumors rarely bleed spontaneously, in contrast to parenchymal cavernous angiomas, which have a spontaneous hemorrhage rate of 25% (3).

We present a case of a large, extra-axial, middle cranial fossa mass arising from the cavernous sinus in a 51-year-old female, and we describe the unique features and complications of this relatively rare intracranial tumor. Preoperative diagnosis is crucial to avoid massive bleeding during resection.

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Case report

History

A 51-year-old woman with a medical history of controlled hypertension became acutely nauseous and had an episode of emesis. A few hours later, she developed a headache and continued having emesis that persisted throughout the night. The following morning, the patient was found unresponsive and was taken to the emergency department.

Examination

The initial noncontrast head CT demonstrated a large, 7.5-cm right extra-axial mass in the right middle cranial fossa with right-to-left shift. There was expansion of the cavernous sinus with encasement of the right cavernous carotid, and scalloping of the bony margins of the middle cranial fossa with enlargement of the right foramen ovale (Fig. 1). Postcontrast head CT demonstrated homogeneous enhancement (Fig. 2).

Contrast-enhanced MRI demonstrated a homogeneously enhancing, lobulated, well-circumscribed mass that had homogeneously low signal intensity on T1 and high signal intensity on T2 and FLAIR (Figs. 3 through 6). The mass resulted in hydrocephalus due to obstruction of the left lateral ventricle, likely at the level of the foramen of monro. Due to avid enhancement, pre-operative embolization was performed.

Angiography

A cerebral angiogram demonstrated three hypertrophied branches from the petrous portion of the internal carotid artery, likely representing the caroticotympanic, cavernous,

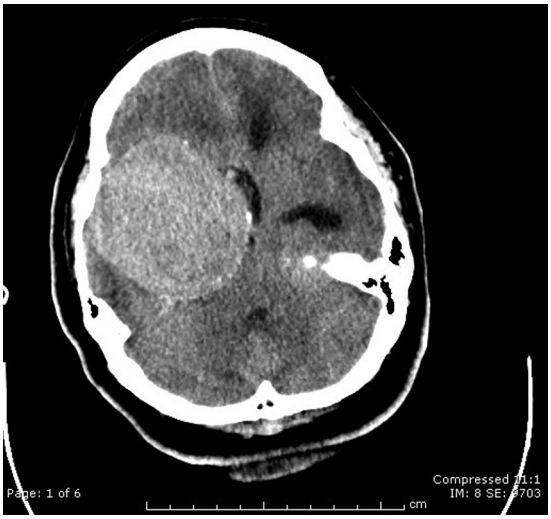

Fig. 1. Noncontrast axial CT image demonstrates a large extra-axial mass in the right middle cranial fossa, expanding into the right cavernous sinus.

and hypophyseal arteries. Subselective catheterization of an internal maxillary branch of a right external carotid artery demonstrated an irregular blushing pattern throughout the intracranial mass (Fig. 7). Embolization of this branch was performed (Fig. 8).

Surgery findings

Surgery demonstrated a vascular tumor, the majority of which was between the sphenoid wing and petrous bone. Excavation of the tumor was challenging due to its extensive vascularity. To limit amount of blood loss, a second surgery was performed at a later date to remove the remainder of the tumor.

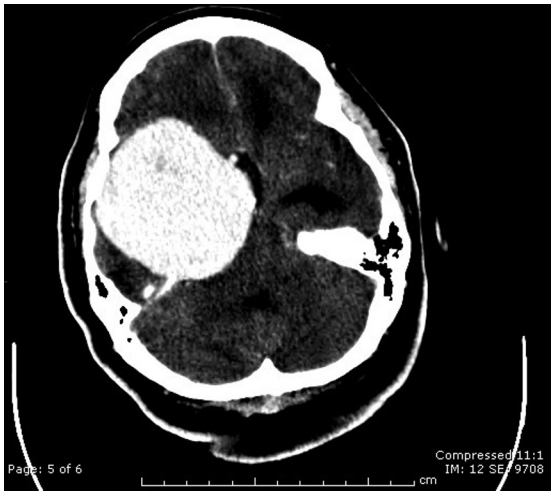

Fig. 2. Post-contrast axial CT image demonstrates homogeneous enhancement.

Pathological findings

Pathology demonstrated a proliferation of blood vessels, which appeared venous in nature. Organizing hemorrhage was seen. Adjacent tissue comprised dense fibrous tissue and large nerve trunks with frequent ganglion cells, without evidence of cerebral parenchyma (Figs. 9 and 10).

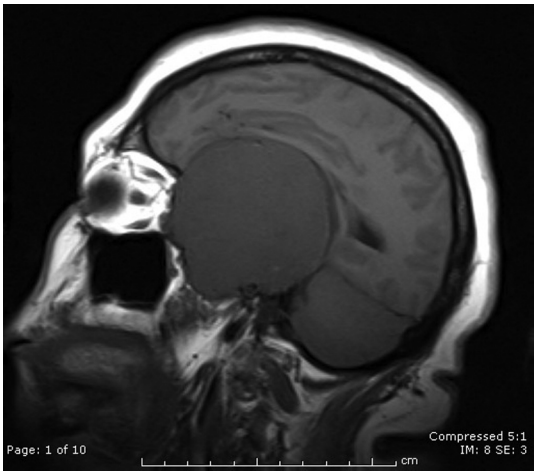

Fig. 3. Sagittal T1 noncontrast image shows buckling of the cortex, supporting extra-axial location.

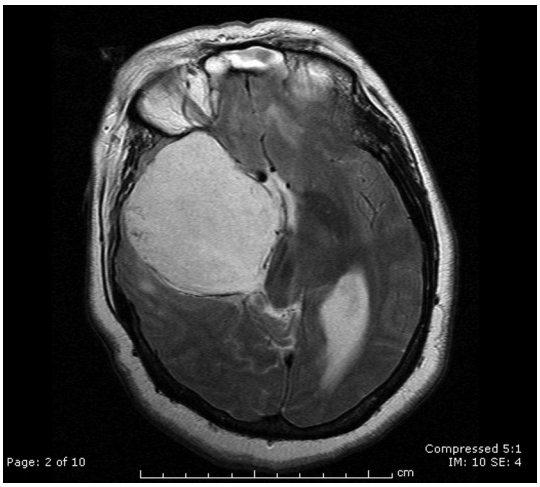

Fig. 4. Axial T2 MRI.

Discussion

The etiology of CSHs is unknown. One hypothesis proposed that the tumor arises within the cavernous sinus, initially deriving its blood supply from the intracavernous ICA and recruiting additional supply from the middle meningeal and accessory middle meningeal arteries (4).

There is a 7:1 predominance in females (5), and it has been hypothesized that estrogen may play a role (2). This is

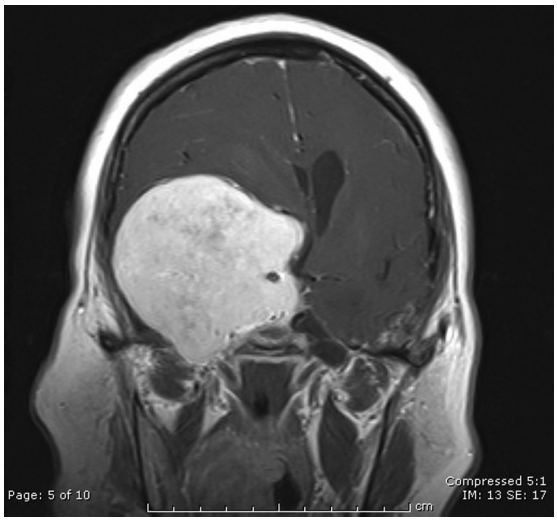

Fig. 5. Post-contrast coronal T1.

also supported by the fact that symptoms of cavernous hemangiomas can worsen during pregnancy and improve after pregnancy (3).

There are three types of CSHs: A, B, and C (4, 2). Type A CSHs are thin-walled, sinusoidal, and contain little to no intervening connective tissue. Type B CHSs are less sinusoidal, are more variable in shape and irregularity, and contain more connective tissue. Given this, type B has fewer

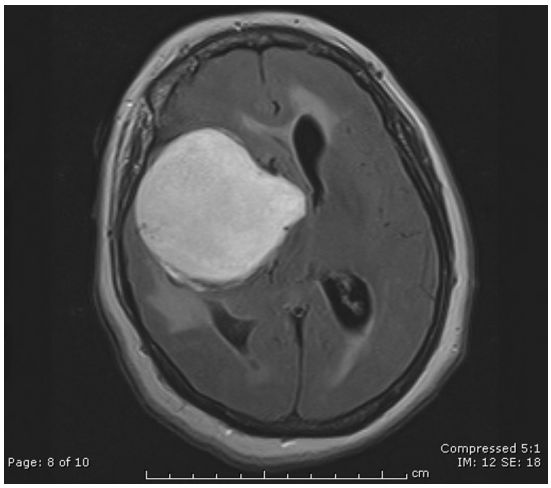

Fig. 6. Post-contrast axial T1.

surgical complications and is more easily removed than type A. Type C has features of both type A and type B (5). The case in this report is a type A.

Symptoms from this tumor occur secondary to increasing pressure and include diplopia, ptosis, and headache, due to the proximity of the tumor to the cranial nerves. If the Gasserian ganglion and cranial nerves are compressed, facial neuralgia and numbness may occur. Occasionally, there may be spontaneous remission of these symptoms. However, the reason for this phenomenon remains unknown (3).

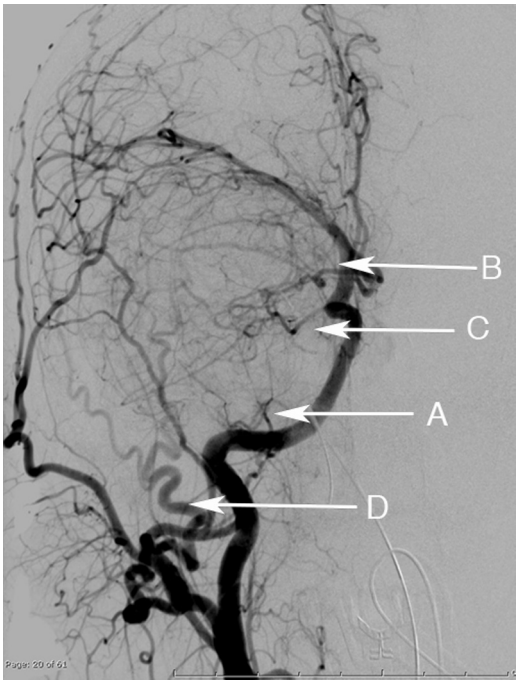

Fig. 7. Frontal angiogram digital subtraction image demonstrates elevation of the right middle cerebral artery and medial deviation of the right internal carotid artery with a mass receiving significantly supply from an internal maxillary branch of the right external carotid artery, which was then embolized (A: caroticotympanic, B: lateral cavernous, C: hypophyseal, D: internal maxillary branch of the right external carotid).

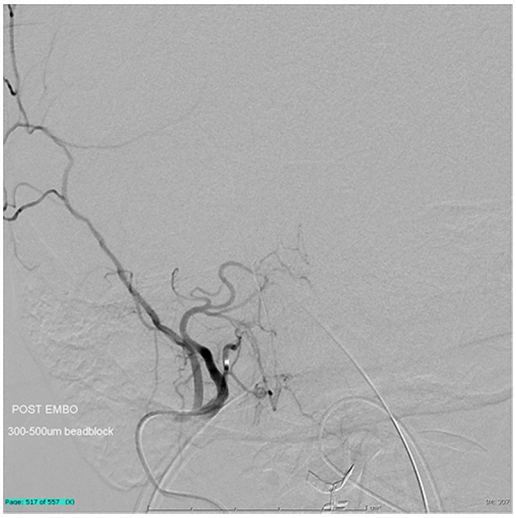

Fig. 8. Frontal angiogram digital subtraction image, post embolization, of a right external carotid artery branch.

The differential diagnosis of lesions in the cavernous space is extensive and includes CSH, meningioma, schwannoma, chordoma, chondroma, chondrosarcoma, metastasis, lymphoma, epidermoid neurofibroma, sarcoid

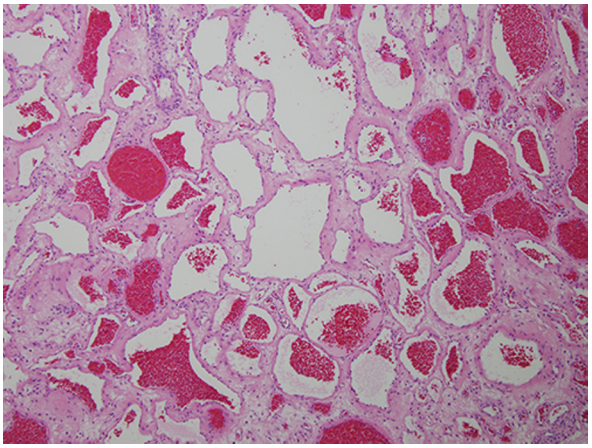

Fig. 9. Hematoxylin and eosin-stained image at 100x magnification showing aggregate of variably-sized, thin-walled venous structures.

granuloma, aspergilloma, Wegener's granulomatosis, chemodectoma, Tolosa Hunt syndrome, cavernous sinus thrombosis, and aneurysm.

A CSH is seen as a well-defined mass that is hypointense or isointense on T1-weighted MRI, while on a T2, it is markedly hyperintense (1). The homogeneity and marked hyperintensity on T2-weighted images and intense homogeneous enhancement seem to be the differentiating factors of CSHs from other lesions, such as meningiomas or schawannomas.

Conclusion

CSHs are relatively rare but have characteristic imaging features. With the proper pre-operative diagnosis, an appropriate plan can be created for these highly vascular lesions, minimizing the risks involved with surgery.

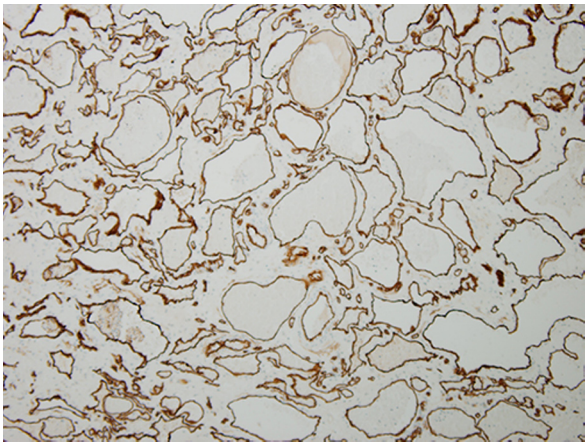

Fig. 10. CD34 immunostain highlights the endothelial cells outlining the venous spaces (100x).

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