CASE REPORT

Extra-Axial Cavernous Hemangioma: Two Case Reports

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ABSTRACT

Two patients with extra-axial cavernous hemangioma who presented with headache and oculovisual disturbances were investigated with computed tomography and magnetic resonance imaging. The lesions masqueraded as basal meningioma, but this diagnosis was not supported by magnetic resonance spectroscopy in one patient. Cerebral angiography with embolization was indicated in one patient, but embolization was not justified in the other. Both patients underwent a pterional craniotomy. The lesions were extradural and highly vascular, necessitating excessive transfusion in one patient in whom gross total resection was achieved, and precluding satisfactory removal in the other. There was no mortality. Transient ophthalmoplegia, the only complication in one patient, was due to surgical manipulation of the cavernous sinus; it resolved progressively over 3 months. Extra-axial skull base cavernous hemangiomas are distinct entities with clinical and radiological characteristics that differ from those of intraparenchymal cavernous malformations. They can mimic meningiomas or pituitary tumors. In some cases, magnetic resonance spectroscopy may narrow the differential diagnoses. Surgical resection remains the treatment of choice, facilitated by preoperative embolization to reduce intraoperative bleeding and by the application of the principles of skull base surgery. Fractionated radiotherapy is an alternative in partial or difficult resections and in high-risk and elderly patients.

KEYWORDS: Cavernous hemangioma, magnetic resonance spectroscopy, skull base surgery

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Skull base surgeons should be aware of the distinct group of cavernomas that reside extra-axially and that are associated with dural or cavernous sinuses. These cavernous hemangiomas (CH) may masquerade as skull base neoplasms. Magnetic resonance spectroscopy (MRS) can help narrow the differential diagnosis if standard imaging fails. The potential intraoperative complication of a devastating hemorrhage may be avoided by preoperative embolization. Fractionated radiotherapy can be beneficial in unresectable tumors or in high-risk patients. This article details two patients with this relatively rare pathology.

CASE REPORTS

Case 1

A 56-year-old man was admitted to our service with a 2-month history of headache that was more pronounced at night and associated with ptosis of the left eye and mild diplopia. A computed tomography (CT) scan performed 2 weeks earlier showed a homogeneously enhancing lesion along the left sphenoid wing that was diagnosed as a suspected meningioma (Fig. 1A,B). Neurological examination revealed left-sided, incomplete third nerve palsy with ptosis but an intact pupillary reaction. Visual acuity was 20/25 in the right eye and 20/70 in the left eye. The patient's laboratory data, including hormonal studies, were within normal limits. A magnetic resonance imaging (MRI) study demonstrated a large, homogeneously enhancing lesion exerting significant mass effect, situated along the left sphenoid wing and anterotemporal fossa, encasing the left internal carotid artery (ICA) and extending over the sella turcica region (Fig. 1C,D). Cerebral angiography outlined the tumor blush. The blood supply was from branches of the internal maxillary artery rather than from the middle meningeal artery. This study was complemented by embolization using polyvinyl alcohol microparticles (Fig. 2A,B).

The next day the patient underwent a left frontopterional craniotomy with gross-total resection of an extra-axial, highly vascular tumor that was dissected from the left internal carotid and optic nerves, but several units of blood had to be transfused. Hemostasis was achieved using collagen fibers (Avitene and Surgicel). The patient's postoperative course was smooth but complicated by left ophthalmoplegia and left facial hypoesthesia along the distribution of V2 and V3 that resolved completely 3 months later. Follow-up CT scan demonstrated excellent resection (Fig. 1E). The histopathological examination was compatible with CH and factor VIII immunohistochemistry demonstrated strong staining of the endothelium (Fig. 2A,B). One year later the patient underwent correction of ptosis of the left eye with a suspensory Gore-tex sling.

Case 2

A 32-year-old woman who was 5 months pregnant was referred to our service with a 1-month history of increasing headaches associated with bouts of vomiting, right facial numbness, and blurred vision. The fundi and visual fields were normal and visual acuity was 20/30 in the right eye and 20/25 in the left. Endocrinological evaluation and hormonal studies were normal. MRI demonstrated a mass lesion along the right sphenoid wing that encased the ICA and extended into the cavernous sinus and suprasellar region.

The patient was followed closely until readmission 2 months after a normal delivery at full term; at that time most of her symptoms had disappeared but some headache remained. MRI with contrast showed intense enhancement of the lesion with significant mass effect and encasement of the siphon of the ICA with extension into the cavernous sinus and sellar region (Fig. 3A,B,C). MRS showed none of the identifiable metabolites typically found in brain tissue or neoplasm (Fig. 3D). On cerebral angiography the cavernous and supra-

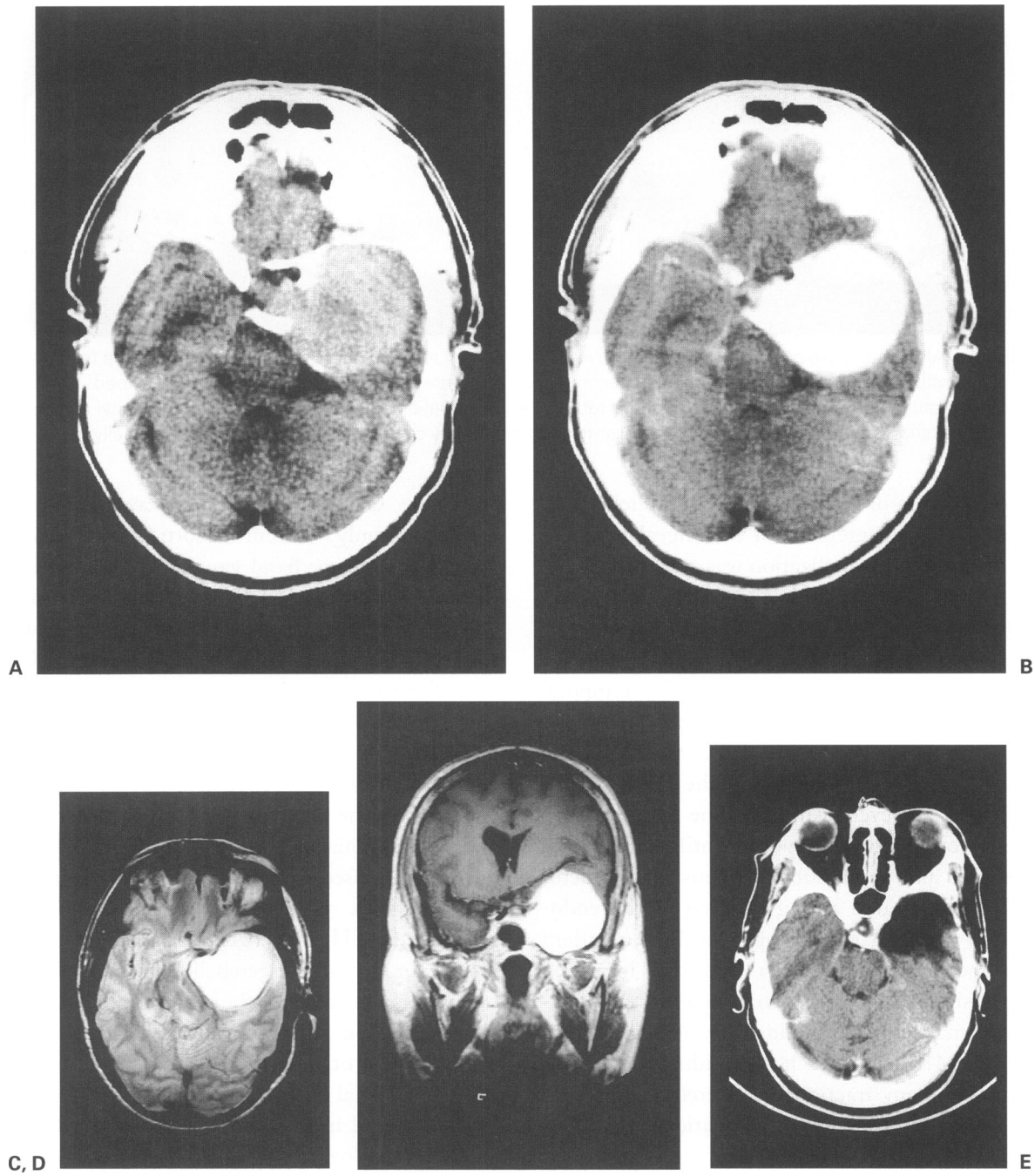

Figure 1 (A) Transverse unenhanced and (B) contrast-enhanced CT scans. The left parasellar mass lesion is spontaneously hyperdense compared with the brain parenchyma. After intravenous contrast injection, it enhances markedly and homogeneously. The (C) transverse unenhanced proton density-weighted fast spin-echo and (D) coronal gadolinium enhanced T1-weighted spin-echo images provide more accurate delineation of the lesion and suggest an extra-axial topography. (E) Postoperative transverse contrast-enhanced CT image shows that the lesion has been resected totally.

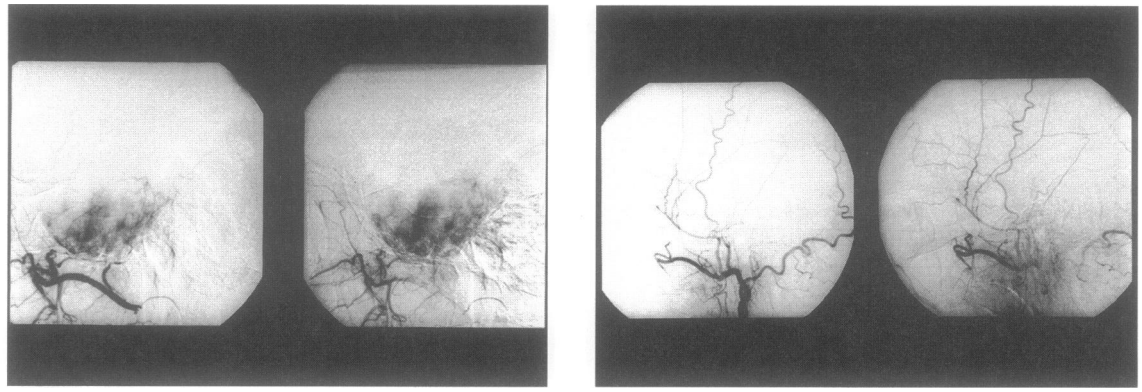

Figure 2 (A) Subselective angiograms of the right internal maxillary artery with a microcatheter shows the feeders and the blush within the tumor. Note the unusual accumulation of contrast and staining within the tumor bed. (B) Digital subtraction angiograms of the external carotid artery in the same patient, postembolization with polyvinyl alcohol microparticles, shows the absence of tumor vascularity and the patency of the internal maxillary artery distally.

clinoid portion of the right ICA was stretched and encased. No enlargement of meningeal branches was seen and no embolization was achieved.

A right fronto-orbital zygomatic craniotomy was performed. The lesion was completely extra-axial, residing in the cavernous sinus with elevation of the basal dura of the anterior temporal fossa. The cavernous sinus was entered through the paramedian, Parkinson, and anterolateral triangles with limited resection of the mass. Hemostasis was achieved using Avitene and Surgicel. The histopathological report identified the lesion as a CH and immunohistochemistry for factor VIII demonstrated strong staining of the endothelium (Fig. 4A,B). Postoperatively, the patient developed ophthalmoplegia that had improved progressively by a 3-month follow-up examination. Visual acuity and fields were normal. Repeat CT and MRI showed a large residual tumor. Radiation therapy/fractionated stereotactic radiotherapy was considered for this patient.

DISCUSSION

The true prevalence of CH has been unveiled with the evolution of MRI and accounts for 5 to 13% of the vascular formations of the central nervous system.[1–3] CH, also known as cavernomas, are most commonly found in subcortical white matter, the brain stem, or basal ganglia. A familial incidence is encountered in 10 to 30% and may rarely be inherited as an autosomal-dominant trait with variable penetration, linked to markers on the long arm of chromosome 7q.[4–7]

An atypical or extra-axial location for a CH is exceedingly rare. These lesions have been encountered in the cerebellopontine angle, intraventricularly, in the pituitary fossa, optic chiasm, Vth and VIIth cranial nerves, and cavernous sinus, or were dural-based in association with dural sinuses.[8–21] In a review of 138 histopathologically documented CH, 13 were extra-axial in the middle fossa, four were in the cerebellopontine angle, and one was associated with the tentorium[3]. The clinical presentation of extra-axial CH is headache and oculovisual or other cranial nerve deficits. In contrast, the typical clinical syndrome associated with intra-axial CH include acute stroke or slowly progressive neurological deficits and seizures.

MRI is the study of choice to establish a radiological diagnosis. MRI shows a large single lesion associated with dural sinuses that is hyperintense on T2-weighted images. Gadolinium uptake is homogeneous and hemosiderin or previous hemorrhage is lacking. In contrast, the classic MRI appearance of intra-axial CH is heterogeneous, small

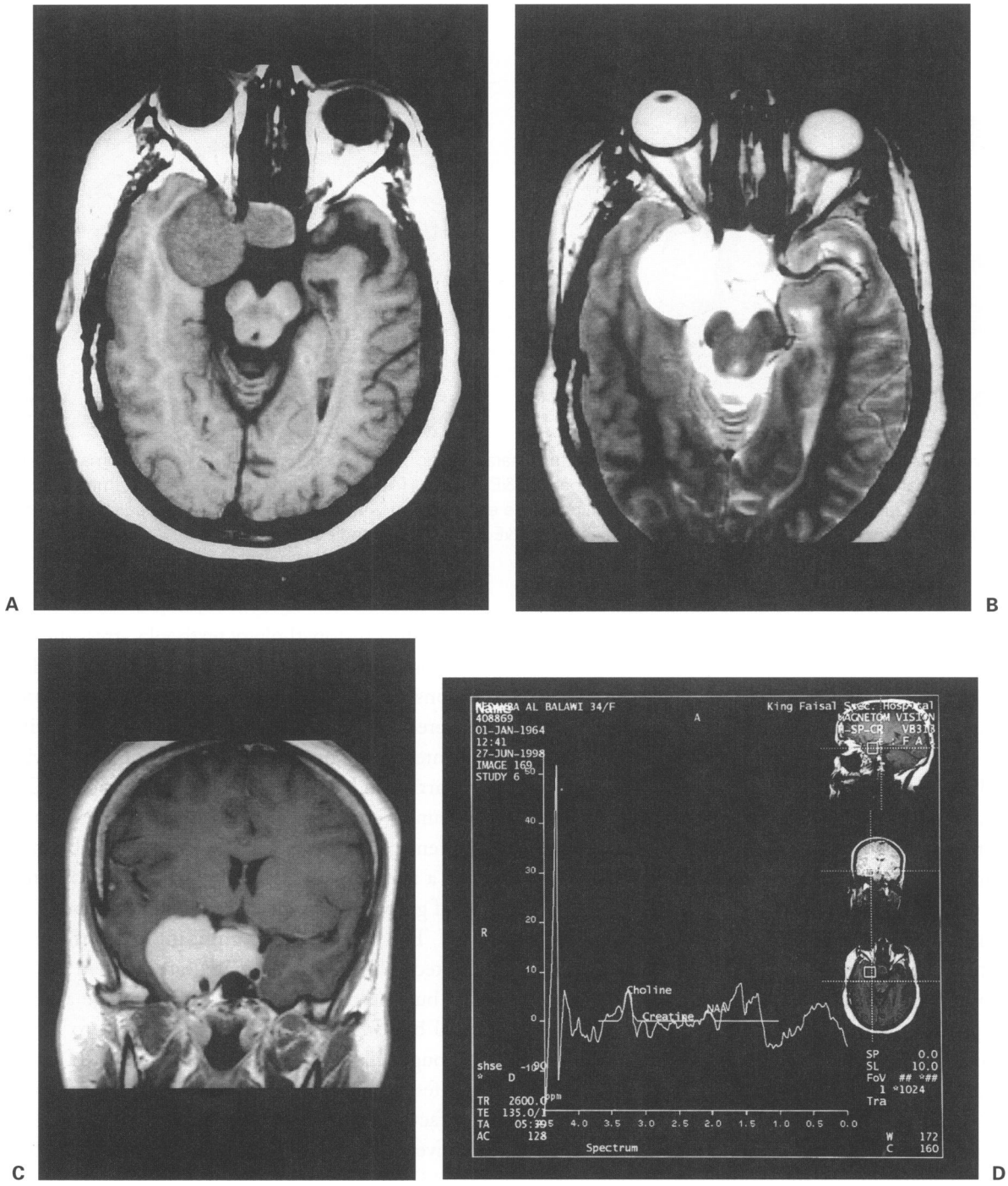

Figure 3 (A) Transverse unenhanced T1-weighted spin-echo, (B) T2-weighted fast spin echo, (C) coronal T1-weighted spin-echo images, and (D) proton MRS using a PRESS sequence with 135 msec echo time. On the unenhanced T1-weighted image, the right para-, intra-, and suprasellar mass lesion is isointense with the cerebral grey matter. On the T2-weighted image, it is markedly hyperintense. After intravenous gadolinium injection, it exhibits a marked and homogeneous signal enhancement. Again, the lesion appears to be extra-axial but the right cavernous sinus is clearly involved and the siphon of the right ICA is partially encased by the tumor. The MRS image shows a minimal amount of choline, creatine, and N-acetyl-aspartate within the sampling voxel, possibly by contamination from the adjacent brain parenchyma, confirming the noncerebral nature of the lesion. The macromolecular range of the spectrum (between 0 and 2.0 ppm) is somewhat noisy but no frank alanine peak (typically seen in meningiomas at the 1.48 ppm level in conjunction with an elevated choline peak) is identified. MRS, magnetic resonance spectroscopy; PRESS, point-resolved spectroscopy; ICA, internal carotid artery.

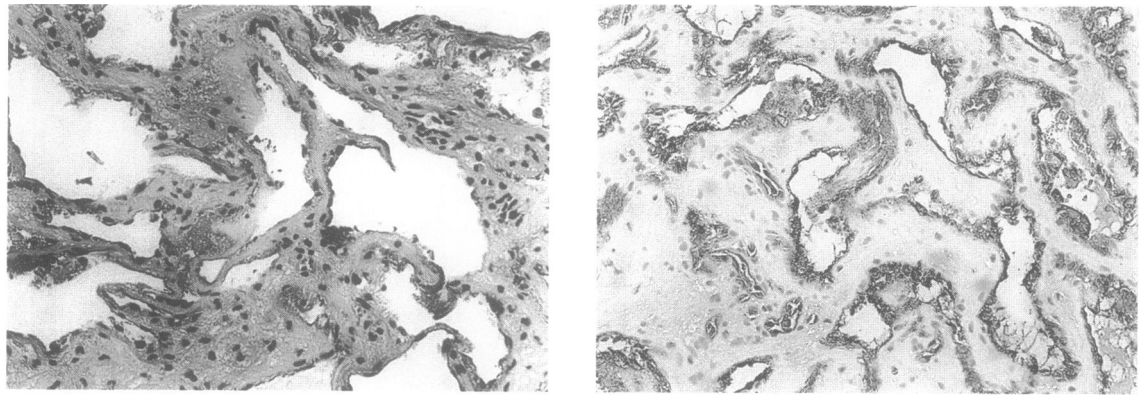

Figure 4 (A) Histopathological photograph shows the characteristic features of a cavernous hemangioma with enlarged capillary spaces embedded in a fibrous stroma (H&E, 250x). H&E, hematoxylin and eosin. (B) Immunohistochemistry for factor VIII demonstrates strong staining of the endothelium with no staining of the fibrous stroma (factor VIII immunohistochemistry, 250x original magnification). H&E, hemotoxylin and eosin.

single or multiple lesions with mixed signal intensity and a reticular appearance, surrounded by a hemosiderin rim of signal void.[21–25] Angiographically, extra-axial CH are highly vascular whereas intraparenchymal cavernomas are low flow and relatively avascular. Extra-axial CH also may mimic extra-axial skull base tumors such as basal meningiomas or tumors of the CPA.[12,14,17] Radiological features such as the absence of bony hyperstosis on CT, a hyperintense signal on T2-weighted MRI images, and atypical meningeal supply and vascular anatomy of the lesion can help exclude the diagnosis of meningioma. The MRS performed on one of our patients helped determine the differential diagnosis of CH compared to meningioma because the metabolites typically associated with meningioma were absent.

Although CH can be quiescent and discovered incidentally, recent studies have shown that the natural history of CH is a more dynamic process and that some lesions appear de novo. The latter may be attributed to capillary proliferation of endothelial cells, vessel dilatation, or repeated hemorrhage from high levels of tissue plasminogen activator (t-PA) followed by thrombosis and recanalization.[26–28] The latter mechanism cannot be applied to extra-axial dural CH.

Most histopathology textbooks stress the lack of distinction between CH and extra-axial CH by demonstrating the typical appearance of closely clustered, abnormally dilated vascular spaces without intervening neural tissue. Based on their review of Harris and Jakobiec's report[29] on intraorbital CH, Lasjaunias et al.[30] advocate that the two lesions are different pathological entities and that CH constitutes a truly tumoral disease with an in vivo potential of growth when located in the liver or orbit.[29,31]

The incidence of significant hemorrhage associated with CH is estimated at less than 1% per year, but the risk of a second hemorrhage after an initial bleeding of a CH increases to 14 to 29%.[32] Although highly vascular, extra-axial CH rarely manifest spontaneous hemorrhaging. The following risk factors may predict that a CH will behave aggressively: (1) pregnancy, (2) familial or multiple CH, (3) previous whole brain or stereotactic irradiation therapy, (4) incomplete resection, (5) associated venous malformation, (6) female gender (suggesting that hormonal factors influence the biological behavior of the CH), and (7) fetal CH. The last can manifest devastating hemorrhage that may reflect the lack of gliosis in the surrounding brain.[28]

Treatment should be tailored according to location and size of the CH and to the patient's age

and clinical symptoms. Symptomatic or accessible lesions should be resected. The optimal approach for resecting an intra-axial deep-seated CH can be guided by stereotactic navigation or intraoperative sonography.[33,34] An extra-axial CH near the cavernous sinus is best managed by using the surgical approach described by Dolenc.[35]

Preoperative embolization, although not very helpful in one of our cases, should complement the resection of extra-axial dural-based CH when feasible to decrease the extent of intraoperative bleeding and the need for transfusion and to enhance the possibility for extended resection. Meyer et al.[14] reported the surgical results of eight patients; resection was total in six and subtotal in two. There were no deaths. The lesion in one of the patients with a subtotal resection mimicked a pituitary tumor. It was approached trans-sphenoidally with limited exposure. The second patient experienced profuse hemorrhage. One of these patients underwent postoperative radiotherapy (4000 rads) which considerably reduced the size of the lesion by the patient's 1-year follow-up examination.

Rigamonti et al.[36] reported that they abandoned total resection in two of three patients due to excessive bleeding. One patient responded favorably to an interphased course of radiotherapy (5000 rads in 5 weeks) before undergoing a successful total resection 6 months later and receiving an iridium-125 implant to prevent a local recurrence. The other patient showed no response to radiotherapy and underwent two additional surgeries to achieve gross total resection. This treatment was complemented with iridium-125 implants. The third patient underwent biopsy only and responded favorably to radiotherapy (5000 rads in 5 weeks) but elected to delay further surgery.

CONCLUSION

Gross total resection remains the treatment of choice for both extra-axial and intra-axial cavernomas. A more conservative approach, such as fractionated/stereotactic radiotherapy, should be considered in partially resected cavernomas and should be reserved for elderly or high-risk patients as a noninvasive treatment option to reduce the size of the lesion and decrease the risk of hemorrhage.[18,37,38]

COMMENTS FOR PUBLICATION

The authors report two patients with extra-axial CH and emphasize the distinct clinical and radiographic characteristics of these lesions. Although these lesions often have been labeled as extra-axial cavernous malformations in the past, they share little in common with their intraparenchymal counterparts. Unlike intraparenchymal cavernous malformations, they are intensely enhancing, highly vascular, and well visualized on CT (Table 1). Histopathologically, they resemble the CH found systemically, including the presence of a cellular stroma that separates the enlarged capillary channels within the lesion.

We strongly agree with the authors that these extra-axial lesions represent a distinct entity and should be classified separately from cavernous malformations. The label "cavernous hemangioma" is most consistent with the clinical, radiographic, and pathological features of these lesions and should be adopted as the accepted nomenclature.

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This paper details two interesting case reports of patients with extra-axial CH treated surgically with fairly good outcomes. This pathology is relatively rare, and, as the authors note, the differential diagnosis obtained from the radiological studies can be important in managing these patients. Specifically, MRS can be very useful, although it remains investigational in a sense. It is interesting that these extra-axial CH differ from intraparenchymal CH in that they are not angiographi-

Table 1 Comparison of Imaging Characteristics of Intraparenchymal Cavernous Malformations and Extra-Axial Cavernous Hemangiomas

Diagnostic Imaging Characteristics	Intraparenchymal Cavernous Malformations	Extra-Axial Cavernous Hemangiomas
Computed tomography		
Visualization of lesion(s)	±	+++
Contrast enhancement	−	+++
Angiographic blush	−	++
Magnetic resonance imaging		
Evidence of acute/subacute hemorrhage	++	−
Evidence of chronic hemorrhage	+++	−
Gadolinium enhancement	−	+++

cally occult. As the authors note, preoperative embolization of these extra-axial CH may be very helpful.

Several cases of extra-axial CH have been reported; a few also have been reported within the cavernous sinus[1] or in the sellar or parasellar regions adjacent to the cavernous sinus.[2] Lombardi et al.[2] described the development of CH within the dural sinuses and showed that endophytic growth into the cavernous sinus or exophytic extension from the sinus wall can occur. Kanaan et al. demonstrate unique points related to using MRS for preoperative assessment and to using microcatheter angiography and embolization to prepare for the surgical treatment of these tumors.

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