

CEREBRAL CAVERNOMA

I. POEATA¹, ST.M. IENCEAN²

¹Clinical Emergency Hospital "Prof Dr Nicolae Oblu" Iasi, University of Medicine and Pharmacy "Gr.T. Popa", Iasi, Romania

²Neurosurgery, Clinical Emergency Hospital "Prof Dr Nicolae Oblu" Iasi, Romania

Cerebral cavernoma can be located in any brain region, be of varying size and present with different clinical disorders. Some cases are found incidentally. Conservative treatment is recommended if the patient has an asymptomatic lesion or the malformation is located in a critical brain region but the patient has only minimal symptoms and no history of symptomatic bleeding or the patient has multiple cavernous malformations and the actual symptomatic lesion could not be determined. The main indications for surgery are based on reductions or control of seizures, reversal of symptoms or deficits related to mass effect, and prevention of hemorrhage or recurrent hemorrhage. Generally surgical results are very good.

Keywords: cerebral cavernoma, gamma knife, hemorrhage, surgery

INTRODUCTION

Cerebral cavernoma or cavernous angiomas are cerebral cavernous malformations and they are relatively rare lesions, comprising 5 to 13% of the central nervous system vascular anomalies. After thrombosed arteriovenous malformations, cavernomas are the second most common histological subgroups of angiographically occult cerebrovascular malformations. With the advent of magnetic resonance imaging (MRI) there has been a substantial increase in the number of patients diagnosed with these lesions. Pathological studies have demonstrated that multiple lesions may represent more than 25% of the cases. There is no sex prevalence, although a familial form has been confirmed by several investigators.

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HISTOPATHOLOGY

Cerebral cavernoma resembles a honeycomb of irregular blood-filled vascular spaces (caverns). The vascular walls are thin and consist of a single layer of

flattened endothelial cells. Recent analysis by transmission electron microscopy show that the thin walls of cerebral cavernoma lack significant subendothelial support and contain very few intact tight junctions between the endothelial cells. These findings help explain the recurrence of microhemorrhage in cerebral cavernoma. The vascular spaces of cerebral cavernomas are separated by a collagenous matrix devoid of elastic lamina or smooth muscle. Deposits of calcium are often found in cavernomas, especially within vascular walls. The lesion is well demarcated from the surrounding normal tissue by a zone of gliosis. The absence of intervening neural tissue previously was recognized as a criterion for diagnosis and a cardinal feature distinguishing cavernous angioma from telangiectasia.

Several pathological variations of cerebral cavernomas can be distinguished and mixed lesions containing an arteriovenous component or combined with capillary telangiectases have been reported. Most cavernomas show evidence of hemorrhage, microscopic or gross, and many show evidence of

repeated hemorrhage. Small hemorrhages followed by organization, fibrosis and calcification probably account for slow progressive growth of cerebral cavernomas in patients with long clinical histories.

CLINICAL PRESENTATION

Patients with a cavernous malformations may present with seizures, hemorrhage or mass lesions. Some cases are found incidentally. There might be a correlation between the clinical and radiological manifestation and the histological type, but there are not enough data to support this concept. The propensity of cerebral cavernomas to bleed is well established. Most of the hemorrhages consist of intralesional or perilesional "slow ooze" or "cluster of bleeding sites" and result in subacute or stepwise worsening of the neurological signs. These bleeding patterns have been attributed to the low blood pressure found in this type of malformation. There are no factors that predict the degree or rapidity of hemorrhage in individual patients. In many patients multiple microscopic hemorrhages occur, but are often not clinically detected. The data regarding the incidence of bleeding and rebleeding of cavernous malformations have the most clinical relevance because they affect the decision regarding surgery. The incidence of symptomatic hemorrhage of cavernous angiomas in general is low. The most important risk factor for subsequent hemorrhage is the occurrence of a prior hemorrhage. An annual hemorrhage rate of 4.5% was described for the patients whose first clinical presentation was hemorrhage.

Several authors proposed that female hormones are implicated in the pathogenesis of hemorrhage from an intracranial cavernous angiomas. Higher bleeding rates from cavernous malformations was found during pregnancy, particularly in the first trimester, which is characterized by vascular proliferation of the endometrium associated with secretion of human chorionic gonadotropin, progesterone, end estrogens. The size of cavernous malformations is known to increase during pregnancy and to decrease after delivery. The increase in the blood volume occurring

during pregnancy might be an important factor in angioma rupture as well.

Cavernous malformations of the brain stem account for between 18 and 22% of all intracranial cavernous malformations (Yasargil). Clinical malignancy of brain stem and basal ganglia cavernomas could be related to the high sensitivity of these areas even to a small amount of bleeding. The rebleeding rate after a first hemorrhage in this group was found to be as high as 21% per year per lesion.

The natural history of familial cavernous malformations is less benign than that of the sporadic form. The rate of symptomatic hemorrhage was found to be higher in this group - 6.5% per patient per year and recently Labauge showed a hemorrhage risk of 2.5% per lesion-year in a study of 40 patients familial cavernous malformations. Eleven patients (27.5%) developed new lesions during a mean follow-up of 3.2 years. Development of de novo lesions in familial form of cerebral cavernous malformations is known and the clinical features have been described.

RADIOGRAPHIC EVALUATION

Size, location, pathological architecture, degree and rapidity of hemorrhage within the lesion presumably determine the neuroradiological appearance and the clinical course.

CEREBRAL ANGIOGRAPHY

Cerebral angiography is relatively insensitive and is diagnostic in only 10%. Delayed imaging during the venous phase and careful subtraction may present the cavernoma as an avascular region in the capillary phase or as an avascular mass with displacement of adjacent vessels.

A dense venous pooling pattern and a localized area of capillary staining that persists into the late venous phase have both been described as diagnostic feature of cavernous malformations.

COMPUTERIZED TOMOGRAPHY

Computerized tomography studies often detect lesions consistent with cavernous malformations, but

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the CT findings are not specific for this entity. The lesion commonly appears hyperdense, or mixed hyperdense and isodense. Mass effect is frequently present. Faint contrast enhancement has been described. By CT criteria alone it is often difficult to differentiate glioma or infarction from a cavernous angioma. Computerized tomography may occasionally miss even relatively large lesions.

MRI

The sensitivity of MRI increases the probability of detecting a cavernous malformation.

T2 - weighted studies are more sensitive than T1 - weighted images. MRI is also particularly valuable in terms of specificity. On T2 - weighted images cavernomas appear as areas of mixed signal intensity with "reticulated" appearance and a prominent surrounding rim of decreased signal intensity, thought to represent hemosiderin. Presence of multiple lesions, a reticulated core of increased and decreased signal intensity, a prominent surrounding rim of decreased signal intensity strongly support the diagnosis of cavernous malformation.

MANAGEMENT

Management strategy are based on a combination of factors including the natural history, age of the patient, location of the lesion, and risk of operative removal. When dealing with a patient harboring several lesions or a family affected by the hereditary form of this condition, an aggressive approach is not always advisable.

CONSERVATIVE TREATMENT

Conservative treatment is recommended if: the patient has an asymptomatic lesion;

the malformation is associated with a medically controlled seizure disorder; the malformation is located in a critical brain region but the patient has only minimal; symptoms and no history of symptomatic bleeding; the patient is elderly or the patient has multiple cavernous malformations and the actual symptomatic lesion could not be determined.

SURGERY

The main indications for surgery are based on reductions or control of seizures, reversal of symptoms or deficits related to mass effect, and prevention of hemorrhage or recurrent hemorrhage. Generally surgical results are very good.

The location of the cavernous malformation is the most significant factor in determining prognoses. Worse surgical outcome was associated with lesions located in the thalamus, basal ganglia, pineal region, brain stem, and spinal cord and with subtotal resections. Although the

definitive risk is not known, it appears that thalamic cavernous angiomas have a significant surgical complication rate and nonoperative approaches have to be seriously considered in stable patients. Surgical excision for a symptomatic brain stem cavernous angioma is recommended because of the poor ability of the brain stem to withstand mass expansion from hemorrhage. For those women with known cavernous malformations who are considering having children, surgical intervention may be entertained prior to conception if the cavernous angioma is accessible. For those patients diagnosed during pregnancy conservative management may be appropriate if the mother is neurologically stable.

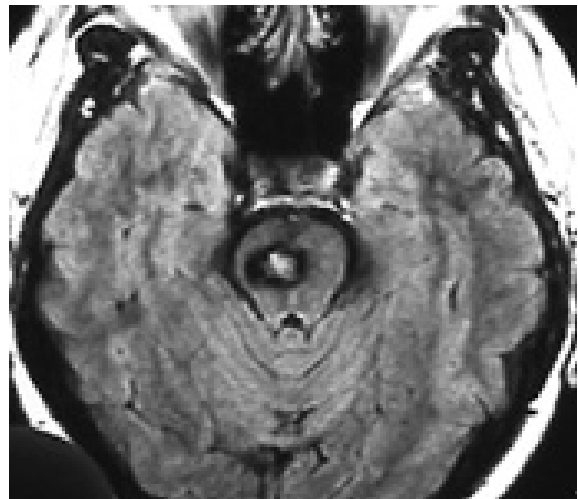




FIG. 1 Axial and sagittal MRI scan showing cavernous malformation in the pons

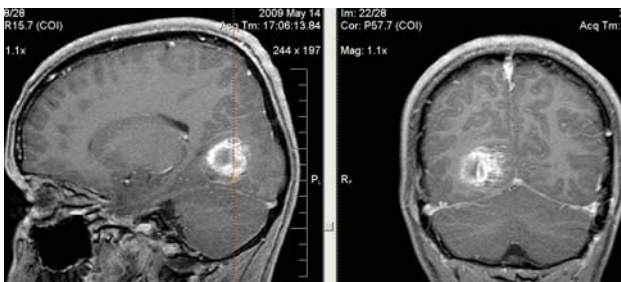


FIG. 2 Right occipital cavernoma

RADIOTHERAPY

The role of conventional radiotherapy and stereotactic radiosurgery for deep cerebral cavernomas is limited because of the possibility of incomplete exclusion and the inherent risk of bleeding during the latency period before definitive vascular obliteration. Additionally, the risk of hemorrhage and of radiation induced complications following stereotactic radiosurgery for cavernous malformations are high.

Although radiosurgery has limited impact on the control of hemorrhage, Gamma Knife radiosurgical treatment is showing promise for the control of seizures

due to cerebral cavernoma. In 49 patients with drug-resistant epilepsy, presumably caused by CM, that were treated with GK, 26 patients (53%) were seizure-free and another 10 patients had a significant decrease in seizure frequency at follow-up (Regis). The authors recommend that GK surgery be considered in the treatment of refractory epilepsy when the cerebral cavernoma is located in a highly functional area.

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