An analysis of the natural history of cavernous angiomas

O. DEL CURLING, JR., M.D., DAVID L. KELLY, JR., M.D., ALLEN D. ELSTER, M.D., AND TIMOTHY E. CRAVEN, M.S.P.H.

Departments of Neurosurgery, Radiology, and Public Health Services, The Bowman Gray School of Medicine, Wake Forest University, Winston-Salem, North Carolina

The advent of magnetic resonance (MR) imaging has permitted the recognition of many angiographically occult vascular malformations before the development of complications and subsequent surgical removal. This study reviews all patients at one institution who had radiographically identifiable vascular malformations believed to represent cavernous angiomas in order to obtain information on the natural history of this particular lesion. All 8131 craniospinal MR images performed at our medical center from January 1, 1986, to November 30, 1989, were reviewed, and 32 patients were identified with 76 lesions meeting the MR imaging criteria for cavernous angioma. Medical histories, physical examination records, and other data from these patients were then reviewed to determine the frequency of complications. Their mean age at latest follow-up examination (or at surgical removal of the lesion) was 37.6 years (range 16 to 72 years). Sixteen patients (50%) had a history of seizures, seven (22%) had focal neurological deficits, and three (9%) had clinically significant hemorrhage attributable to the cavernous angioma; six patients (19%) were asymptomatic. The estimated risk of hemorrhage for this population is 0.25%/person-year of exposure; the estimated risk of seizure development is 1.51%/person-year. Eight patients underwent surgical procedures, resulting in improved seizure control and/or lessened neurological deficit. Although these lesions are often excised with relative ease and minimal morbidity, the potential risks and benefits of surgery must be weighed carefully before removal of these relatively benign malformations.

KEY WORDS • cavernous angioma • occult arteriovenous malformation • seizure • magnetic resonance imaging • hemorrhage

VASCULAR malformations of the brain are traditionally classified into four major categories: arteriovenous malformations (AVM's), cavernous angiomas, venous angiomas, and capillary telangiectasias. Although the pathological appearance of these lesions is known, their natural history is less well understood. Some information is available on the natural course of AVM's but less on the so-called "cryptic" malformations, which typically are not visualized on cerebral angiography. These angiographically occult lesions are most commonly small or thrombosed AVM's or cavernous angiomas, occasionally capillary telangiectasias, and rarely venous angiomas.

The development of high-field magnetic resonance (MR) imaging has provided a noninvasive diagnostic tool that has the potential to help differentiate among these angiographically occult lesions with a high degree of sensitivity and specificity. The purpose of this study was to identify and review a series of patients with radiographically identifiable cavernous angiomas in an attempt to gather information on the natural history of this lesion.

Clinical Material and Methods

The log records of all craniospinal MR images obtained at the North Carolina Baptist Hospital between January 1, 1986, and November 30, 1989, were reviewed retrospectively to identify patients with possible intracranial vascular malformations. All such images were then reviewed by an experienced neuroradiologist to identify those lesions with a high probability of representing cavernous angiomas. The criteria used were similar to those described previously: an inhomogeneous hyperintense signal surrounded by a hypointense ring on the T2-weighted sequence. For MR studies performed using a contrast agent, additional criteria were that the central portion of the lesion should enhance and that there should be no large feeding or draining vessels visualized near the lesion. Images obtained between January 1, 1986, and May 17, 1987


J. Neurosurg. / Volume 75 / November, 1991

702
Natural history of cavernous angiomas

TABLE 1
Data from 32 cases of cavernous angioma identified retrospectively by magnetic resonance (MR) imaging

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Sex</th>
<th>Date of Birth</th>
<th>Date of MR Imaging</th>
<th>Lesions</th>
<th>CT ATG EEG</th>
<th>Studies Performed</th>
<th>Signs &amp; Symptoms</th>
<th>Date of Surgery</th>
<th>Date of Last Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>8/27/53</td>
<td>2/24/87</td>
<td>1 In</td>
<td>+ - -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2/24/87</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>7/21/56</td>
<td>3/28/87</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>1983</td>
<td>-</td>
<td>3/30/87</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>4/16/51</td>
<td>6/1/87</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>1985</td>
<td>-</td>
<td>6/29/87</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>7/7/44</td>
<td>7/7/87</td>
<td>1 S</td>
<td>+ + -</td>
<td>-</td>
<td>+</td>
<td>hemianopia</td>
<td>10/5/89</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>10/15/42</td>
<td>8/5/87</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>1987</td>
<td>(hemifacial weakness)</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>12/22/50</td>
<td>9/23/87</td>
<td>1 S</td>
<td>- - -</td>
<td>-</td>
<td>-</td>
<td>hemianesthesia</td>
<td>11/29/89</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>4/11/40</td>
<td>2/28/88</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>-</td>
<td>11/29/89</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>8/5/70</td>
<td>3/2/88</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>1972</td>
<td>-</td>
<td>8/11/88</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>9/14/37</td>
<td>5/13/88</td>
<td>16 S 3 In</td>
<td>+ + +</td>
<td>-</td>
<td>+</td>
<td>1981</td>
<td>1/2/3/89</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>10/23/47</td>
<td>8/24/88</td>
<td>1 In</td>
<td>- - -</td>
<td>-</td>
<td>hemifacial anesthesia</td>
<td>8/11/89</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>4/20/51</td>
<td>8/26/88</td>
<td>7 S 1 In</td>
<td>+ + +</td>
<td>-</td>
<td>9/8/86</td>
<td>ecotomas [hemiparesis]</td>
<td>11/15/89</td>
</tr>
<tr>
<td>14</td>
<td>F</td>
<td>5/30/16</td>
<td>9/26/88</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>-</td>
<td>9/26/88</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>3/30/72</td>
<td>10/6/88</td>
<td>6 S 1 In</td>
<td>+ + +</td>
<td>-</td>
<td>1988</td>
<td>-</td>
<td>11/29/89</td>
</tr>
<tr>
<td>16</td>
<td>M</td>
<td>2/22/52</td>
<td>10/13/88</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>1977</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>M</td>
<td>1/3/54</td>
<td>10/25/88</td>
<td>1 S</td>
<td>+ + +</td>
<td>-</td>
<td>1980</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>M</td>
<td>5/17/47</td>
<td>11/21/88</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>1988</td>
<td>-</td>
<td>9/15/89</td>
</tr>
<tr>
<td>19</td>
<td>M</td>
<td>9/12/27</td>
<td>11/29/88</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>-</td>
<td>11/29/89</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>M</td>
<td>1/30/33</td>
<td>12/28/88</td>
<td>1 S</td>
<td>- - -</td>
<td>-</td>
<td>-</td>
<td>11/30/89</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>9/27/38</td>
<td>1/20/89</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>1978</td>
<td>-</td>
<td>11/29/89</td>
</tr>
<tr>
<td>22</td>
<td>F</td>
<td>12/7/59</td>
<td>2/16/89</td>
<td>6 S 1 In</td>
<td>+ + +</td>
<td>-</td>
<td>1983</td>
<td>-</td>
<td>10/5/89</td>
</tr>
<tr>
<td>23</td>
<td>F</td>
<td>10/26/72</td>
<td>4/18/89</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>-</td>
<td>7/19/89</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>F</td>
<td>5/31/66</td>
<td>4/25/89</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>1984</td>
<td>-</td>
<td>4/27/89</td>
</tr>
<tr>
<td>25</td>
<td>F</td>
<td>3/16/41</td>
<td>5/16/89</td>
<td>1 S</td>
<td>+ - -</td>
<td>-</td>
<td>1971</td>
<td>-</td>
<td>6/27/89</td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>8/17/58</td>
<td>6/7/89</td>
<td>1 In</td>
<td>+ + +</td>
<td>-</td>
<td>-</td>
<td>diplopia, N/V</td>
<td>12/16/88</td>
</tr>
<tr>
<td>27</td>
<td>M</td>
<td>10/3/72</td>
<td>6/8/89</td>
<td>1 In</td>
<td>+ + +</td>
<td>-</td>
<td>(hemiparesis)</td>
<td>7/3/89</td>
<td>11/22/89</td>
</tr>
<tr>
<td>28</td>
<td>F</td>
<td>12/28/50</td>
<td>6/29/89</td>
<td>1 S</td>
<td>+ + -</td>
<td>-</td>
<td>1964</td>
<td>-</td>
<td>6/29/89</td>
</tr>
<tr>
<td>30</td>
<td>M</td>
<td>11/4/63</td>
<td>11/9/89</td>
<td>4 S S</td>
<td>+ + +</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11/9/89</td>
</tr>
<tr>
<td>31</td>
<td>M</td>
<td>1/19/73</td>
<td>11/24/89</td>
<td>1 In</td>
<td>+ - -</td>
<td>-</td>
<td>8/11/89 [hemianesthesia, N/V]</td>
<td>8/12/89</td>
<td>11/24/89</td>
</tr>
<tr>
<td>32</td>
<td>F</td>
<td>11/6/48</td>
<td>1/11/90</td>
<td>1 S</td>
<td>+ + -</td>
<td>-</td>
<td>-</td>
<td>11/90</td>
<td></td>
</tr>
</tbody>
</table>

* Abbreviations: CT = computerized tomography; ATG = arteriogram; EEG = electroencephalogram; HA = headache; Seiz = seizures (with date of onset); Hemorr = CT-confirmed hemorrhage; In = infratentorial; S = supratentorial; N/V = nausea/vomiting; + = feature present; - = feature absent.

† Parentheses indicate previous history of focal neurological deficit, which resolved prior to last contact; brackets indicate deficits present after hemorrhage.

(Cases 1 and 2 in Table 1) were performed on a 0.5-tesla MR imaging system; images obtained thereafter (Cases 3 through 32) were obtained at 1.5-tesla. After July 6, 1988 (Cases 11 through 32), MR images were obtained both before and after the intravenous administration of gadolinium-diethylene-triaminepenta-acetic acid at a dose of 0.1 mmol/kg.

Hospital charts and radiographic and pathological studies of patients identified by this method were reviewed, and telephone and office contacts were made to obtain additional clinical information. Of special interest were cases with a history of headache, seizure, hemorrhage, or focal neurological deficit.

Descriptive statistics (means, standard deviations, and frequencies) of patient characteristics were calculated. Incidence rates of seizures and hemorrhages were estimated: patient-years were calculated assuming that the lesion had been present from birth either to the time of last contact or to surgical removal. Furthermore, it was assumed that the risk of an event occurrence was equal throughout the patient’s lifetime.

Results

During the study period, 8131 craniospinal MR images were obtained. From among that number, studies in 32 patients met the stringent criteria for the diagnosis of cavernous angioma (Table 1), yielding a case incidence rate of 0.39%. The male/female ratio was 1.11 (17 males, 15 females). The mean patient age at last contact (or at surgical removal of a single lesion) was 37.6 years (range 16 to 72 years). Six patients had multiple lesions, resulting in a total of 76 lesions among the 32 patients. Sixty-five lesions (86%) were located...
superior to the tentorium cerebelli. Twenty-three patients (72%) had only supratentorial lesions, five (16%) had only infratentorial lesions, and four (12%) had both supratentorial and infratentorial lesions. Additional diagnostic studies were performed in the majority of patients: cerebral arteriography in 18, cranial computerized tomography (CT) in 27, and electroencephalography in 14. In most patients, these studies had been performed at the time of symptom onset, which had occurred before the advent of MR imaging.

Eleven patients (34%) had a history of chronic headache and 16 (50%) had a seizure disorder (epilepsy), referable to the location of an intraparenchymal cavernous angioma. The estimated risk of developing seizures is 1.51%/person-year of exposure for the entire study population (16 subjects/1056 person-years), 1.34%/person-year for the 26 patients with single lesions (12 subjects/895 person-years), and 2.48%/person-year for the six patients with multiple lesions (four subjects/161 person-years). The median patient age (± standard error of the median) at time of first seizure was 42 ± 5.84 years. The median age at onset for the single-lesion group was 42 ± 3.78 years and for the multiple-lesion group 24 ± 8.57 years.

Although hemosiderin deposition around the lesion was identifiable on all MR images, only three patients (9%) exhibited clinically significant, radiographically identifiable hemorrhages: two in the pons and one in the angular gyrus. The estimated risks of a patient in this population developing a clinically significant hemorrhage are 0.25%/person-year of exposure (three events/1195 person-years) and 0.10%/person-year for each lesion (three events/2890 person-years). All patients survived their initial hemorrhage with significant recovery at the time of last contact. No patient has suffered a repeat hemorrhage to date.

Focal neurological deficits attributable to the location of the cavernous angioma were noted at the time of diagnosis for seven patients (22%); a remote history of prior transient focal neurological deficits was identified in an additional three. Six patients (19%) had no symptoms or signs related to their cavernous angiomas.

Surgical resection was performed and pathological confirmation obtained in seven patients. The histological appearance of the lesions was similar to that previously described:31 dilated thin-walled vascular channels without intervening parenchyma, often with hemosiderin deposition and gliosis identifiable in the adjacent brain (Fig. 1). Evacuation of a pontine hematoma without excision of the primary lesion was performed in one patient (Case 31). All patients experienced postoperative improvement in seizure control and/or neurological deficit.

Discussion

Many series in the literature outline the presentation and pathology of cryptic vascular malformations. However, given the previous radiographically occult nature of these lesions, nearly all cases have been diagnosed either at surgery following the development of a significant complication or at autopsy. Although the many surgical series have helped to identify the potential symptoms and complications associated with cavernous lesions (seizure, hemorrhage, and focal deficit), they provide little information regarding the course of surgically untreated lesions and no insight into the frequency of asymptomatic lesions. Autopsy series, such as that published in 1968 by McCormick, et al.,32 help to elucidate the relative incidence of the particular lesions (cavernous angiomas accounted for 80 (16%) of 510 vascular intracranial lesions in that series); autopsy series also provide insight into the potential risk of significant hemorrhage relative to that of other vascular malformations (cavernous angiomas were responsible for only two of the 51 posterior fossa hemorrhages secondary to vascular malformations in that series). Unfortunately, autopsy series provide little information regarding the clinical signs and symptoms arising from these lesions. Thus, although it is known that cavernous angiomas are relatively uncommon and that they can...
Natural history of cavernous angiomas

cause significant symptoms, very little is known regarding the relative frequency of those symptoms in a patient harboring this lesion.

The series evaluated here provides some insight into the natural history of predominantly conservatively treated cavernous angiomas. On the basis of data from this series and others, six specific areas relating to the natural history of cavernous angiomas can be discussed: incidence, location, growth, presentation, diagnosis, and treatment.

Incidence of Cavernous Angiomas

The incidence of cavernous angiomas within the general population remains unknown. Although our series is drawn from a select population (over 8000 patients with some symptom or sign that led to the performance of a craniospinal MR image), it does represent a step toward approximating the general population. We identified only six patients with apparently asymptomatic cavernous angiomas from among this large group, but we would expect that the proportion of asymptomatic cavernous angiomas in the general population to be greater. This trend is supported by the study of families with hereditary cavernous angioma, in which investigation of asymptomatic family members identified a significant number of lesions. As the availability and use of MR imaging increase, the incidence of perceived cavernous angioma will likely increase as well.

Cavernous angiomas occur in all age groups. Although the youngest patient in this series was 16 years old, several young children have been identified with cavernous angiomas, their diagnosis having most commonly been made following the onset of seizures. The male-to-female incidence is approximately equal.

Location of the Lesions

The majority of lesions in this series (86%) were located supratentorially. In an autopsy study of 510 intracranial vascular malformations in 487 patients, McCormick, et al., noted 21 cavernous angiomas in the posterior fossa and 59 in the cerebrum. Voigt and Yagargil found 76.8% of lesions reported in the literature to be supratentorial and 20.7% to be infratentorial. Among 51 lesions reviewed by Giombini and Morello, 90% were supratentorial and 10% infratentorial, which is the approximate proportion expected, given the distribution of brain volume above and below the tentorium. Although no spinal cord lesions were identified in our series, such lesions have been noted by others.

Despite the apparent preponderance of cavernous angiomas above the tentorium cerebri, the belief exists among some that hemorrhage may be more likely to occur from infratentorial lesions; indeed, two of the three hemorrhages in our series did occur in the brain stem. However, although some evidence suggests that AVM's have a greater tendency to hemorrhage in the posterior fossa, there is no clear documentation that this is the case with regard to cavernous angiomas. To the contrary, Giombini and Morello reported 12 patients with cavernous angiomas presenting with hemorrhage, all of whose hemorrhages had occurred supratentorially. Among the 40 patients presenting with hemorrhage in the series of Simard, et al., only five (12.5%) of the hemorrhages had occurred in the posterior fossa. Because hemorrhage in the posterior fossa, when it does occur, is more likely to be clinically manifest and subsequently diagnosed, it is surprising that hemorrhages in that region are not recognized more frequently. The distribution of cavernous angiomas is roughly representative of the distribution of nervous tissue along the craniospinal axis, and the likelihood of hemorrhage appears to be approximately equal among all lesions, regardless of their location.

Lesion Growth

Several case reports of enlarging cavernous angiomas exist, suggesting some slow neoplastic potential to those lesions. However, such reports have generally been dependent on CT scanning for documenting the growth.

Whereas some authors have suggested that growth of the vascular portion of the malformation by budding of capillaries does indeed occur, others believe that it is only the surrounding hemorrhagic cyst cavity or shell of hemosiderin deposition and gliosis that enlarges with time. Although CT scanning can seldom distinguish between the various portions of the lesion, high-field MR imaging (particularly T₂-weighted images) can differentiate the peripheral hemosiderin ring from the central nidus of the cavernous angioma. Growth of the core of the malformation was not demonstrated in any patient in this series, although an increase in the size of the hypointense hemosiderin ring was seen in one patient (Case 32); this finding lends support to the second explanation of the apparent growth of cavernous angiomas. A definitive answer to this question of growth should be obtained in the future as more patients are followed for longer periods with contrast-enhanced high-field MR imaging.

Clinical Presentation

The presentation of all intracranial vascular malformations is similar, and is usually characterized by the onset of seizures, focal neurological deficits, or hemorrhage. However, although the symptoms or signs are similar, their frequency of occurrence varies, this being dependent upon the pathological type of malformation. Whereas hemorrhage may be the most common presenting symptom in patients with AVM's, seizures appear to be the most common presenting event in patients with cavernous angiomas (62% of symptomatic patients in this series). The estimated risk of a patient developing seizures in this series was 1.51%/person-year of exposure. As expected, the risk of developing seizures for the patient with multiple lesions appears to be higher and the age of onset to be earlier.
general angiomas, malformation. Genital eunous zures obviously be to individuals. Pre dispo sed present ing rhage life of that 0.25%/year. This subsequently improve sponta neously, presumably as the unrecognized hematoma or hemorrhage resolves. Indeed, three of seven patients presenting with identifiable “focal deficits” in this series were improving without specific therapy by the time of last contact: an additional three patients had acutely occurring focal deficits in the past that resolved completely by the time of last contact. This explanation is supported by the intraoperative observation by Simard, et al.,34 of cysts containing liquefied blood or old hematoma in many patients operated on for a mass or focal deficits. The second explanation presumes that thrombosis and lysis of red blood cells occurs within the malformation, with slow and progressive deposition of hemosiderin and subsequent gliosis within the surrounding parenchyma, eventually producing an adequate seizure focus.7 This theory seems more plausible in patients with no history of apoplectic events, and likely explains the pathogenesis and late onset of seizures in many patients with cavernous angiomas.

Diagnosis of Cavernous Angioma

High-field MR imaging is clearly being established as a major diagnostic tool in the evaluation of intracranial vascular malformations. This is particularly true with reference to cavernous angiomas. High-field MR imaging is very sensitive in identifying intracranial lesions of all types, and the finding of the “classic” cavernous angioma appears to be of relatively high specificity (Fig. 2). Even large cavernous lesions mimicking the configuration of AVM’s can usually be distinguished on MR imaging by the absence of nearby major vessels (Fig. 3). In this series, no identification of a lesion as a “classic” cavernous angioma by MR imaging was subsequently refuted following review of all other available radiographic and pathological data (including histopathological review of the seven resected lesions). In contrast, many reports demonstrate the relatively low sensitivity and lack of specificity of CT and low-field MR imaging in the detection of these lesions.1,7,11,18,24,28,29,32,36-38,40 High-field MR imaging is currently the

Fig. 2. Magnetic resonance (MR) images from Case 18 demonstrating the “classic” MR appearance of a cavernous angioma. Left: Axial T2-weighted image showing a round nodular hyperintense core with surrounding hypointense halo, and no edema or mass effect. P = posterior. Center: Sagittal T1-weighted image without contrast medium. F = frontal. Right: Axial T1-weighted image following gadolinium administration, demonstrating slight enhancement of the central core.
Natural history of cavernous angiomas

The dominant role of surgery in the diagnosis and therapy of cavernous angiomas is undergoing re-evaluation now that new imaging techniques are identifying this lesion more frequently and in patients without symptoms. Even though fatal hemorrhages secondary to cavernous angiomas can occur, the data in this series suggest that the risk of significant hemorrhage from a cavernous angioma is relatively low, and thus that prevention of hemorrhage should not be an absolute indication for surgical resection. However, if documented recurrent hemorrhage with progressive neurological deterioration occurs secondary to a cavernous lesion, the risk of rebleeding following an initial hemorrhage is unknown at this time.

The role of surgery in the management of cavernous angioma-induced focal deficit is also somewhat uncertain. Clearly, many patients will recover spontaneously without surgical lesion resection. Therefore, the surgical accessibility of the lesion, as well as the severity or significance of the focal deficit and its causal relationship to the cavernous angioma, must be considered carefully. Certainly, some patients should undergo surgery in an attempt to improve or halt the progress of their neurological symptoms.

The risk of developing seizures secondary to a cavernous angioma appears to be relatively high, although most such seizures can be controlled adequately by medical regimens. The removal of the cavernous angioma (including the surrounding “glial scar” and hemosiderin-laden tissue) may, however, reduce the frequency and severity of seizures. Indeed, surgical resection can often be performed with relative ease and minimum morbidity, and may result in a complete “cure” of the seizure disorder. Although resection of cavernous angiomas may indeed improve seizure manageability, treatment decisions obviously must be individualized, based on the general health of the patient, the accessibility of the lesion, the patient’s attitude toward the presence of a vascular brain lesion, and the patient’s tolerance to anti-seizure medications. Medically intractable seizures in a patient with an accessible causative cavernous angioma are a clear indication for surgical resection.

The role of stereotactic radiosurgery in the management of cavernous angiomas has yet to be defined. Although these lesions are usually well circumscribed and occur in areas difficult to access surgically, making them potentially good “targets” for radiosurgery, the efficacy of this form of treatment in the management or prevention of complications has not been adequately demonstrated. Furthermore, although MR imaging appears to be highly specific for these lesions, a pathological rather than radiographic diagnosis should be made before the administration of high-dose intracranial irradiation.

Conclusions

Cavernous angiomas are more common than previously appreciated, and indeed may be present asymptptomatically in a significant number of the population. Although it was once believed that the prognosis of patients with cavernous angiomas not treated surgically was very poor, new information suggests that this is not necessarily true. Indeed, the natural history of cavernous angiomas appears to be relatively benign, with seizures being the most common clinical manifestation, and significant hemorrhage being quite uncommon. Cavernous angiomas can often be excised completely with relative ease, but the potential risks and benefits of surgery for each patient must be weighed carefully before deciding upon removal of these relatively benign malformations.

Although our clinical series provides some insights into the natural history of cavernous angiomas, it would be our recommendation that a large prospective study be undertaken in an effort to answer many of the questions that remain about the natural history and ideal management of these lesions. The use of high-field MR imaging will greatly enhance and facilitate the future study of these previously occult vascular malformations.

References


O. D. Curling, Jr., et al.