Prevalence and natural history of arachnoid cysts in adults

Clinical article

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Object. Arachnoid cysts are a frequent finding on intracranial imaging. The prevalence and natural history of these cysts in adults are not well defined.

Methods. We retrospectively reviewed the electronic medical records of a consecutive series of adults who underwent brain MRI over a 12-year interval to identify those with arachnoid cysts. The MRI studies were reviewed to confirm the diagnosis. For those patients with arachnoid cysts, we evaluated presenting symptoms, cyst size, and cyst location. Patients with more than 6 months’ clinical and imaging follow-up were included in a natural history analysis.

Results. A total of 48,417 patients underwent brain MRI over the study period. Arachnoid cysts were identified in 661 patients (1.4%). Men had a higher prevalence than women (p < 0.0001). Multiple arachnoid cysts occurred in 30 patients. The most common locations were middle fossa (34%), retrocerebellar (33%), and convexity (14%). Middle fossa cysts were predominantly left-sided (70%, p < 0.001). Thirty-five patients were considered symptomatic and 24 underwent surgical treatment. Sellar and suprasellar cysts were more likely to be considered symptomatic (p < 0.0001). Middle fossa cysts were less likely to be considered symptomatic (p = 0.01). The criteria for natural history analysis were met in 203 patients with a total of 213 cysts. After a mean follow-up of 3.8 ± 2.8 years (for this subgroup), 5 cysts (2.3%) increased in size and 2 cysts decreased in size (0.9%). Only 2 patients developed new or worsening symptoms over the follow-up period.

Conclusions. Arachnoid cysts are a common incidental finding on intracranial imaging in all age groups. Although arachnoid cysts are symptomatic in a small number of patients, they are associated with a benign natural history for those presenting without symptoms.

Key Words • arachnoid cyst • natural history • prevalence

The prevalence and natural history of arachnoid cysts in adults are not well defined. With the increasing use of MRI and CT, there has been a corresponding increase in the number of incidentally diagnosed arachnoid cysts.49,50,90,93 Prior studies of smaller groups of adults with arachnoid cysts have estimated cyst prevalence as between 0.3% and 1.7%.8,27,49,50,90,93 We recently studied a large population of children undergoing brain MRI and found that the prevalence of arachnoid cysts in children was 2.6%, slightly higher than these prior estimates in adults.3 In our current study, we evaluated a consecutive series of adult patients undergoing intracranial imaging to define the age-related prevalence of arachnoid cysts in this population.

The long-term behavior of arachnoid cysts in adults is also not well understood. There are many case reports of arachnoid cysts that have become larger or smaller, and there are cases in which arachnoid cysts spontaneously resolved.12,24,31,49,50,67,79,80,85,105 However, there are no studies evaluating a large series of adults with untreated arachnoid cysts who have undergone clinical and imaging follow-up. Although arachnoid cysts may be treated surgically by endoscopic fenestration,24,31,49,50,67,79,91,105 craniotomy for fenestration,15,31,55,79 or shunt placement15,34,67,73,79 these operations are associated with potential morbidity.24,39,48,55,57,58,79,80,85,105 A better understanding of the prevalence and natural history of these cysts in adults may lead to better definition of surgical indications for adult patients with arachnoid cysts discovered on imaging. We analyzed the outcome in those patients who presented for clinical evaluation of their arachnoid cyst to better define the natural history of these cysts in adults.
Arachnoid cysts in adults

Methods

Patient Identification

Following approval by the University of Michigan Institutional Review Board, we retrospectively reviewed the electronic medical records of all patients 19 years of age and older who underwent brain MRI at the University of Michigan between January 1, 1997, and September 30, 2009, to identify those patients with an arachnoid cyst found on MRI. All MRI studies were performed on either a 1.5-T or a 3-T device. We used the Electronic Medical Record Search Engine (EMERSE) to identify our population of interest; EMERSE is a search engine that queries all free-text documents within the electronic medical records of a specified patient population. For this study, we used EMERSE to identify a population in which the terms “arachnoid” or “cyst” were noted in the clinical or imaging records. Afterward, we manually read and viewed the medical and imaging records of all patients in this population to identify those who met the inclusion criteria. During the study period, 48,417 individual patients aged 19 years or older underwent intracranial imaging.

For each patient, we collected demographic information, including age and sex. In patients with arachnoid cysts, additional data were collected including clinical evaluation reports, presenting symptoms, indication for initial MRI study, and, if any surgical treatment was pursued, the surgical data including choice of surgery and treatment outcomes. Images and records were reviewed in every case to confirm the diagnosis of arachnoid cyst, and the medical records were reviewed in every case to evaluate for the presence of symptoms. Imaging characteristics of the arachnoid cysts, including size and location, were noted. Size of the cysts was measured in the anteroposterior, transverse, and craniocaudal dimensions. Arachnoid cysts were considered symptomatic if the neurologist or neurosurgeon who evaluated the patient’s condition had recorded a concern that symptoms were due to the arachnoid cyst.

Cyst location was identified and organized into the following locations: anterior cranial fossa, middle cranial fossa, cerebral convexity, interhemispheric, retroschemellar, suprachiasmatic, lateral cerebellum, CPA, ambient cistern, quadrigeminal cistern, and brainstem (perimedullary or prepontine). The MRIs were directly examined for 609 of the 661 patients in whom arachnoid cysts were identified. In 52 patients, imaging had been previously destroyed, but reports by attending radiologists and/or neurosurgeons confirmed the presence, location, and characteristics of the arachnoid cyst.

Natural History Data Collection

Patients with untreated arachnoid cysts who had both clinical and imaging follow-up longer than 6 months were evaluated to assess the natural history of the lesions. Cysts were assessed for any changes in size. Data on any radiographic or clinical changes that occurred during the follow-up period, including progression of symptoms, were collected from the clinical records, and we noted any relationship to the arachnoid cyst and surgical treatment, if any. If more than 2 MRI studies were performed in an individual patient, we evaluated the first and last studies to reflect the longest follow-up interval. Median follow-up time was calculated using Kaplan-Meier survival methods censored for surgical treatment.

Data Analysis

The prevalence of arachnoid cysts in this consecutive series of MRI evaluations was calculated for all patients, as well as for sex-specific and age-specific groups. An analysis was performed to identify the effect of age and sex on the presence of arachnoid cysts using univariate and multivariate logistic regression. Analyses were performed to evaluate the effect of demographic factors and initial imaging characteristics on cyst location and size, clinical symptoms, and surgical intervention using Fisher exact test and ANOVA testing. For patients with adequate natural history, univariate and multivariate logistic regression was performed to evaluate whether demographic factors or initial imaging appearance predicted change in cyst size over time. Data were analyzed using SPSS version 16.0 software (SPSS, Inc.).

Results

Arachnoid cysts were identified in 661 patients (1.4%). Men had a higher prevalence of arachnoid cysts than women (p < 0.00001) (Table 1, Fig. 1). Arachnoid cysts were found in 356 (1.8%) of 20,327 men compared with only 305 (1.1%) of 28,090 women. There was no significant change in prevalence with increasing age in the adult age range. Thirty patients had more than 1 cyst; a total of 696 arachnoid cysts were identified in 661 individuals.

The most common locations for arachnoid cysts were the middle fossa (237 cysts [34%]), retroschemellar (232 [33%]), and cerebral convexity (98 [14%]) (Table 2). Middle fossa arachnoid cysts were further classified into Galassi type, with 78% being Galassi Type I, 19% Galassi Type II, and 3% Galassi Type III. The mean cyst size was 2.2 × 2.6 × 2.5 cm (anteroposterior × transverse × craniocaudal dimensions) for cysts in all locations. Two hundred seventy-two (39%) of the cysts were on the left side and 167 (24%) were on the right, with the remainder (37%) located in the midline. This left-side predominance was mostly due to the marked tendency for middle fossa cysts to occur on the left. Of the 237 middle fossa arachnoid cysts, 166 (70%) were on the left side and 71 (30%) were on the right (p < 0.0001). This left-side predominance was true for all Galassi classes. In contrast, CPA arachnoid cysts were more commonly identified on the right side (29 cysts) than the left (19 cysts) (p = 0.001).

Men had a greater prevalence of arachnoid cysts than women. This sex difference was especially marked for retroschemellar cysts. Of these, 63% were found in men (p = 0.001). CPA arachnoid cysts, however, were more commonly found in women (p = 0.009). Finally, men had larger arachnoid cysts (mean size, 2.3 × 2.7 × 2.7 cm) compared with women (mean size, 2.1 × 2.5 × 2.4 cm) (p = 0.02).

Symptoms and Surgical Treatment

Thirty-five patients (5.3%) presented with symp-
toms thought to be related to the arachnoid cyst (Tables 3 and 4). Cysts in certain locations—suprasellar cysts and cysts in the CPA, ambient cistern, and quadrigeminal cistern—had a higher likelihood of presenting with symptoms than cysts in other locations. Six (67%) of 9 sellar or suprasellar arachnoid cysts presented with symptoms (p < 0.0001), most often due to obstructive hydrocephalus. Seven (15%) of 48 patients with CPA arachnoid cysts presented with symptoms (p = 0.006), most often ipsilateral sensorineural hearing loss, tinnitus, or vertigo. Two (29%) of 7 patients with ambient cistern arachnoid cysts presented with symptoms (p = 0.042), and 4 (20%) of 20 patients with quadrigeminal cistern arachnoid cysts presented with symptoms (p = 0.015). Cysts in middle fossa and retrocerebellar locations, however, were less likely to be considered symptomatic. In 5 (2.1%) of the 237 patients with middle fossa arachnoid cysts, the cysts were considered symptomatic (p = 0.01). Of the symptomatic middle fossa cysts, 1 was Galassi Type I, 3 were Galassi Type II, and 1 was Galassi Type III. The mean age of patients with symptomatic arachnoid cysts was slightly younger (42.0 years) than that of those with asymptomatic cysts (49.5 years) (p = 0.01). Symptomatic cysts were larger (mean size 2.7 × 3.3 × 3.4 cm) than those considered asymptomatic (mean size 2.2 × 2.6 × 2.5 cm) (p = 0.02). Sex was not associated with symptomatic presentation. Although left-side cysts were more common, they were not more likely to be considered symptomatic.

At presentation, 24 patients (3.6%) underwent surgical intervention. Of the arachnoid cysts that were initially treated, 6 were sellar or suprasellar, 4 were retrocerebellar, 4 were in the quadrigeminal cistern, 3 were in the CPA, 3 were in the middle fossa, 3 were along the convexity, and 1 was supracerebellar. Sellar or suprasellar and quadrigeminal arachnoid cysts were more likely to be treated surgically than cysts in other locations (p < 0.0001 and p = 0.004, respectively). Middle fossa arachnoid cysts were less likely to be treated surgically than cysts in other locations. Only 3 (1.3%) of 237 middle fossa cysts were treated surgically (p = 0.01).

Two patients presented with subdural hygromas thought to be related to the arachnoid cyst. One of these patients was completely asymptomatic and remained asymptomatic at follow-up. The other initially presented with bilateral hygromas with a small hemorrhage into the subdural space; this patient underwent surgical treatment and had complete resolution of symptoms at follow-up. Another patient with a middle fossa arachnoid cyst presented with a ruptured middle cerebral artery aneurysm with hemorrhage into the arachnoid cyst. This patient underwent craniotomy for aneurysm clipping and made an excellent neurological recovery. Each of these patients who presented with symptomatic hygromas and hemorrhages were neurologically normal at last follow-up.

**Natural History**

The inclusion criteria for natural history analysis were met in 203 patients with 213 arachnoid cysts, who had more than 6 months of both clinical and imaging follow-up. The mean follow-up period for these patients was 3.8 ± 2.8 years (range 0.5–11.8 years), with a median follow-up time of 3.3 years (95% CI 2.8–3.8 years). None

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### TABLE 1: Number of patients with arachnoid cysts incidentally discovered on brain MRI at a single institution, stratified by patient age and sex*

<table>
<thead>
<tr>
<th>Age Group (yrs)</th>
<th>No. of Pts Undergoing MRI</th>
<th>No. of Pts w/ Arachnoid Cysts</th>
<th>MRI Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Pts</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>19–30</td>
<td>7,230</td>
<td>2,618</td>
<td>4,612</td>
</tr>
<tr>
<td>31–40</td>
<td>8,510</td>
<td>3,151</td>
<td>5,359</td>
</tr>
<tr>
<td>41–50</td>
<td>10,004</td>
<td>4,156</td>
<td>5,848</td>
</tr>
<tr>
<td>51–60</td>
<td>9,052</td>
<td>4,079</td>
<td>4,973</td>
</tr>
<tr>
<td>61–70</td>
<td>6,646</td>
<td>3,235</td>
<td>3,411</td>
</tr>
<tr>
<td>71–80</td>
<td>4,913</td>
<td>2,312</td>
<td>2,601</td>
</tr>
<tr>
<td>81–90</td>
<td>1,933</td>
<td>734</td>
<td>1,199</td>
</tr>
<tr>
<td>91–100</td>
<td>129</td>
<td>42</td>
<td>87</td>
</tr>
<tr>
<td>total</td>
<td>48,417</td>
<td>20,327</td>
<td>28,090</td>
</tr>
</tbody>
</table>

* Pts = Patients.

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**FIG. 1.** Bar graph illustrating arachnoid cyst prevalence in patients undergoing MRI stratified by sex and age group. Imaging prevalence of arachnoid cysts in males is greater than in females (p < 0.00001). The prevalence of arachnoid cysts does not change significantly with advancing age in adulthood.
of these patients had an initial recommendation for surgical intervention at the time of presentation. At the last follow-up, 5 cysts were larger than at presentation and 2 cysts were smaller. Of the 5 cysts that increased in size, 3 were middle fossa Galassi Type I cysts and 2 were convexity arachnoid cysts. Decreased size was found in 1 retrocerebellar cyst and 1 quadrigeminal arachnoid cyst. Only 1 patient with cyst enlargement had new neurological symptoms. The mean initial size of all the cysts that enlarged was $2.5 \times 3.8 \times 3.6$ cm, and the size at long-term follow-up was $2.9 \times 4.1 \times 4.1$ cm, with a mean growth of 0.4 cm in each dimension. Age, sex, initial cyst size, or cyst location did not predict cyst enlargement in univariate and multivariate analyses. None of the patients in the natural history group developed cyst-associated hemorrhage or symptomatic hygroma during the follow-up period.

### TABLE 2: Location of 696 arachnoid cysts incidentally discovered on brain MRI in 661 patients

<table>
<thead>
<tr>
<th>Location</th>
<th>All (% of total)</th>
<th>Left (% of location)</th>
<th>Right (% of location)</th>
<th>Midline (% of location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>middle fossa</td>
<td>237 (34)</td>
<td>166 (70)</td>
<td>71 (30)</td>
<td>0</td>
</tr>
<tr>
<td>retrocerebellar</td>
<td>232 (33)</td>
<td>22 (9)</td>
<td>9 (4)</td>
<td>201 (87)</td>
</tr>
<tr>
<td>convexity</td>
<td>98 (14)</td>
<td>53 (54)</td>
<td>44 (45)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>CPA</td>
<td>48 (7)</td>
<td>19 (40)</td>
<td>29 (60)</td>
<td>0</td>
</tr>
<tr>
<td>supracerebellar</td>
<td>21 (3)</td>
<td>1 (5)</td>
<td>0</td>
<td>20 (95)</td>
</tr>
<tr>
<td>lateral cerebellar</td>
<td>11 (2)</td>
<td>5 (45)</td>
<td>6 (55)</td>
<td>0</td>
</tr>
<tr>
<td>quadrigeminal cistern</td>
<td>20 (3)</td>
<td>0</td>
<td>0</td>
<td>20 (100)</td>
</tr>
<tr>
<td>sellar/suprasellar</td>
<td>9 (1)</td>
<td>0</td>
<td>0</td>
<td>9 (100)</td>
</tr>
<tr>
<td>ambient cistern</td>
<td>7 (1)</td>
<td>3 (43)</td>
<td>4 (57)</td>
<td>0</td>
</tr>
<tr>
<td>brainstem</td>
<td>5 (0.7)</td>
<td>0</td>
<td>3 (60)</td>
<td>2 (40)</td>
</tr>
<tr>
<td>anterior fossa</td>
<td>4 (0.6)</td>
<td>3 (75)</td>
<td>1 (25)</td>
<td>0</td>
</tr>
<tr>
<td>interhemispheric</td>
<td>4 (0.6)</td>
<td>0</td>
<td>0</td>
<td>4 (100)</td>
</tr>
<tr>
<td>total</td>
<td>696</td>
<td>272 (39)</td>
<td>167 (24)</td>
<td>257 (37)</td>
</tr>
</tbody>
</table>

### TABLE 3: Location of symptomatic arachnoid cysts*

<table>
<thead>
<tr>
<th>Location</th>
<th>All Arachnoid Cysts</th>
<th>Symptomatic Arachnoid Cysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>middle fossa</td>
<td>237</td>
<td>5 (2.1)†</td>
</tr>
<tr>
<td>retrocerebellar</td>
<td>232</td>
<td>7 (3.0)</td>
</tr>
<tr>
<td>convexity</td>
<td>98</td>
<td>3 (3.1)</td>
</tr>
<tr>
<td>CPA</td>
<td>48</td>
<td>7 (14.6)‡</td>
</tr>
<tr>
<td>supracerebellar</td>
<td>21</td>
<td>1 (4.8)</td>
</tr>
<tr>
<td>lateral cerebellar</td>
<td>11</td>
<td>0 (0)</td>
</tr>
<tr>
<td>quadrigeminal cistern</td>
<td>20</td>
<td>4 (20.0)‡</td>
</tr>
<tr>
<td>sellar/suprasellar</td>
<td>9</td>
<td>6 (66.7)‡</td>
</tr>
<tr>
<td>ambient cistern</td>
<td>7</td>
<td>2 (28.6)‡</td>
</tr>
<tr>
<td>brainstem</td>
<td>5</td>
<td>0 (0)</td>
</tr>
<tr>
<td>anterior fossa</td>
<td>4</td>
<td>0 (0)</td>
</tr>
<tr>
<td>interhemispheric</td>
<td>4</td>
<td>0 (0)</td>
</tr>
<tr>
<td>total</td>
<td>696</td>
<td>35 (5.0)</td>
</tr>
</tbody>
</table>

* Values represent numbers of cysts (% of total).
† Clinically significant decreased incidence of symptoms.
‡ Clinically significant increased rate of symptoms.

Five patients in the natural history group initially presented with symptoms thought to be potentially related to the arachnoid cyst. Two patients presented with episodic vertigo, and the other 3 patients presented with hearing loss (1 patient), headache (1 patient), and seizures (1 patient). After a mean follow-up interval of 5.3 years, these patients’ symptoms remained stable or improved with no change in cyst size. Only 2 patients developed new or worsening symptoms after long-term follow-up. One patient with a convexity arachnoid cyst measuring $4 \times 6 \times 7$ cm initially presented with no symptoms. The patient then presented 3.8 years later with a new seizure and headache; the cyst was found to have enlarged, and the increase in size was associated with increasing mass effect and midline shift. This patient underwent surgical fenestration. The cyst decreased in size and the patient’s symptoms improved. Another patient presented with an asymptomatic $1.6 \times 2.2 \times 1.9$–cm CPA arachnoid cyst. Over a span of 3.6 years, the patient developed slowly progressive ipsilateral sensorineural hearing loss with tinnitus with no clear increase in cyst size. This patient

### TABLE 4: Neurological signs and symptoms found in 35 patients with cysts that were considered symptomatic by the treating physician

<table>
<thead>
<tr>
<th>Sign or Symptom</th>
<th>No. of Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>headache</td>
<td>15</td>
</tr>
<tr>
<td>hydrocephalus</td>
<td>6</td>
</tr>
<tr>
<td>ataxia/gait imbalance</td>
<td>6</td>
</tr>
<tr>
<td>seizures</td>
<td>4</td>
</tr>
<tr>
<td>dizziness</td>
<td>4</td>
</tr>
<tr>
<td>visual changes</td>
<td>3</td>
</tr>
<tr>
<td>nausea/vomiting</td>
<td>3</td>
</tr>
<tr>
<td>hearing loss</td>
<td>2</td>
</tr>
<tr>
<td>vertigo</td>
<td>2</td>
</tr>
<tr>
<td>speech abnormalities</td>
<td>1</td>
</tr>
<tr>
<td>cervical myelopathy with syrinx</td>
<td>1</td>
</tr>
</tbody>
</table>
underwent cyst fenestration. Postoperatively, the patient’s symptoms stabilized but did not resolve.

Discussion

The increasing use of intracranial imaging, especially MRI, has led to more frequent diagnosis of arachnoid cysts. Despite the increased identification of arachnoid cysts, the prevalence and natural history of arachnoid cysts in adults has not been well described. We evaluated the largest series of intracranial arachnoid cysts to date. Of 48,417 consecutive patients aged 19 years or older who underwent brain MRI at our institution, 661 were found to have a total of 696 arachnoid cysts, resulting in an imaging prevalence of 1.4% in adults. In contrast to our prior report on pineal cysts in adults that found a decline in pineal cyst prevalence with advancing age, we identified arachnoid cysts in adults of all ages and the prevalence did not change significantly over the adult age range. Since arachnoid cysts and pineal cysts are pathologically distinct, it is not surprising that their clinical behavior is also different.

There are several prior reports on arachnoid cyst prevalence on imaging. Other smaller studies have reported lower estimates of cyst prevalence between 0.3% and 1%. In contrast to our own report, these studies did not report age distribution of the population studied and did not focus their methods on the detection of arachnoid cysts. In the largest study of cyst prevalence prior to our own, Weber et al. performed 2536 MRI studies on military recruits aged 17 years and older and found 43 arachnoid cysts (1.7%), an estimate that is close to our estimate of cyst prevalence in adult men (1.8%).

Despite the common occurrence of cysts on intracranial imaging, misunderstandings of arachnoid cyst prevalence have persisted. For instance, many articles and chapters from the past decades up to the present day state that these lesions constitute 1% of all intracranial mass lesions. This belief predates the modern imaging era and is most likely a result of an estimate made by R. G. Robinson in 1971 based on his own clinical experience. Given the results of our own study as well as other prior studies, it is impossible to reconcile the common imaging prevalence of arachnoid cysts with the frequently stated belief that these lesions constitute merely 1% of intracranial mass lesions. Although the appropriateness of the term “lesion” as it applies to many arachnoid cysts may be debated, arachnoid cysts must constitute a significantly greater percentage of intracranial space-occupying findings than has commonly been assumed since the time of Robinson’s original report. The frequently stated notion that these cysts constitute only 1% of intracranial mass lesions is clearly incorrect and should be abandoned.

As with our pediatric series, we found a significantly greater prevalence of arachnoid cysts in males. Middle fossa cysts were most common and a left-side predominance was noted, especially for cysts in the middle fossa. Previous studies have also described gender and location peculiarities. Many have identified a greater prevalence of arachnoid cysts in males and most have found that the middle fossa is the most common cyst location. A left-side predominance for middle fossa cysts has also been noted in many prior studies.

In our series, there was a tendency for CPA cysts to be located on the right side. Although others have also noted this tendency, the smaller numbers of cysts in this location make the reliability of this finding less clear.

Given the prevalence of these cysts on imaging, individuals will undoubtedly present with arachnoid cysts along with many unrelated conditions as coincidental associations. Case reports of such associations do not prove causation and, by suggesting that such a relationship is possible or even likely, these reports are misleading. Recent examples include cases of arachnoid cysts found in patients with intracranial aneurysms, Langerhans cell histiocytosis, parkinsonism, personality disorders, conversion disorder, depression, psychosis, and coital headache. Individual case reports have also attempted to suggest a connection between arachnoid cysts and various syndromes such as Kabuki syndrome, Chudley-McCullough syndrome, oculo-ectodermal syndrome, Apert syndrome, Sturge-Weber syndrome, Usher syndrome, Aicardi syndrome, Proteus syndrome, neurofibromatosis, Marfan syndrome, and undefined syndromes including undescended testes and absence of the tibia. Since arachnoid cysts are common, these reports of patients with cysts in association with any of these syndromes do nothing to prove anything more than a coincidental association. The strongest evidence for an association with arachnoid cysts has been provided by a case control study on autosomal dominant polycystic kidney disease and arachnoid cysts by Schievink et al. Finally, case reports of twins or siblings with arachnoid cysts must also be viewed with skepticism in the context of what is now known about cyst prevalence.

Although arachnoid cysts occasionally present with neurological signs or symptoms, many authors agree that a majority of arachnoid cysts are asymptomatic and are found incidentally in most cases. Even in instances where neurological symptoms are present, it is often difficult to properly correlate nonspecific symptoms with the finding of an arachnoid cyst. This is especially true in the case of common symptoms such as headaches, which arise frequently in the general population. Intracranial arachnoid cysts may occasionally cause hydrocephalus, cranial neuropathy, seizures, headaches, cognitive complaints, or other focal neurological deficits such as hemiparesis, visual impairment, or cerebellar complaints. Cysts in certain locations, such as suprasellar and CPA cysts, appear to be significantly more likely to cause symptoms than cysts in other locations.

The natural history of these lesions in adults has not been previously well described. There are reports of cysts arising de novo as well as cysts becoming larger or smaller over time, and even spontaneously resolving. We recently reported on the natural history of these lesions in children and found a generally benign natural history. In this report, we extended these findings.

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by studying the natural history of 213 arachnoid cysts in 203 adult patients initially selected for nonsurgical management. Over the mean follow-up interval of 3.8 years, only 5 patients developed cyst enlargement and only 2 patients developed new symptoms that were considered possibly a result of the arachnoid cyst. Furthermore, several other patients who had cyst enlargement over time had only small or modest increases in cyst dimensions, and these were not associated with any new symptoms. Based on these data, it is clear that cyst growth or clinical worsening is very unusual for incidentally discovered arachnoid cysts in adults.

Surgical treatment of arachnoid cysts may occasionally result in complications, including subdural hygroma, pseudomeningocele and CSF leak, wound complications, subdural empyema, meningitis, cranial nerve palsy, spasticity, hemiparesis, hydrocephalus, seizure, and the need for more than 1 surgical treatment after failure of an initial surgical attempt. Shunt placement carries the additional risk of shunt dependency and overdrainage. In a recent review of published cases of endoscopic treatment of middle cranial fossa arachnoid cysts, Johnson et al. found that this treatment resulted in subdural hygromas and subdural hematomas in 9% and 5% of cases, respectively. Surgical treatment of posterior fossa cysts may occasionally result in iatrogenic hindbrain herniation. Although any surgical technique to address an arachnoid cyst may result in complication, the preference for any given surgical technique over another has been debated. Shunt placement carries the additional risk of shunt dependency and overdrainage. In a recent review of published cases of endoscopic treatment of middle cranial fossa arachnoid cysts, Johnson et al. found that this treatment resulted in subdural hygromas and subdural hematomas in 9% and 5% of cases, respectively. Surgical treatment of posterior fossa cysts may occasionally result in iatrogenic hindbrain herniation. Although any surgical technique to address an arachnoid cyst may result in complication, the preference for any given surgical technique over another has been debated.

Despite the risks associated with any attempt to treat arachnoid cysts surgically, many authors agree that clearly symptomatic arachnoid cysts should be treated. In patients with symptomatic arachnoid cysts, treatment may lead to lasting relief of focal neurological deficits. Seizures and headaches, however, often persist despite adequate surgical treatment of the cyst. Some have proposed that arachnoid cysts are often symptomatic and argue that any impairment of mental function is likely to improve following surgery. This has been used as a justification for surgery by some surgeons. Others have suggested a role for intracranial pressure monitoring or SPECT analysis of cerebral blood flow to assist with surgical decision making. Given the difficulty in properly identifying which cysts are symptomatic and given the potential for surgical morbidity, further definition of treatment indications would be helpful.

Contemporary case series continue to report on surgical treatment of asymptomatic cysts as well as cysts associated with minimal or nonspecific symptoms. A recent survey of neurosurgeons suggests that 18% would consider surgery for an incidentally identified Galassi Type II sylvian arachnoid cyst, even in asymptomatic cases, with 13% citing the potential risk of bleeding as an indication for prophylactic treatment. Of the surveyed surgeons, 35.5% would recommend surgery of this cyst if the patient presented with headaches. Hopefully, a better understanding of the prevalence and natural history of these cysts will lead to more informed surgical decisions. Our own data indicate that the natural history of arachnoid cysts that are selected for nonsurgical treatment is benign. This should reinforce the decision to avoid surgical treatment for arachnoid cysts in adults, except in the unusual instances in which a cyst is clearly responsible for specific symptoms. Furthermore, the fact that arachnoid cysts are incidentally found with such frequency should alert surgeons to be extremely cautious when contemplating surgical treatment. It defies belief that the very large number of people with arachnoid cysts could be viewed as potential surgical candidates. We do not offer surgery for patients without symptoms. We acknowledge that this clinical judgment is sometimes difficult when potential symptoms are common and nonspecific. This point will remain controversial. The data in our series do not attempt to clarify the role of surgery in cases that are only possibly symptomatic. Nevertheless, given the prevalence of arachnoid cysts on MRI, as well as the prevalence of headaches and cognitive complaints in the general population, there will clearly be a significant coincidental—not causative—relationship between these 2 groups. Therefore, we recommend caution when ascribing the cause for any common and nonspecific symptom to the presence of an arachnoid cyst. Finally, an increase in size alone without associated symptoms is not an indication for surgery in our practice, although we monitor these patients with more frequent clinical evaluations.

Hemorrhage into the subdural space or into the supratentorial compartment poses a potential surgical threat. The potential for hemorrhage has been used as a justification for prophylactic treatment of asymptomatic arachnoid cysts. Although we acknowledge that hemorrhage is possible in these patients, we believe that this is a rare event. In our prior analysis of children with arachnoid cysts, only 1 of 309 patients presented with a posttraumatic cystic hemorrhage. One of our adult patients in this series presented with intracystic hemorrhage from aneurysm rupture and 1 presented with a subdural hemorrhage that was thought to be related to the arachnoid cyst. None of the patients in the natural history group experienced a hemorrhage during the follow-up interval. Furthermore, as was the case with our own patients, hemorrhages associated with arachnoid cysts that have been reported in the literature are associated with generally good outcomes, even when surgical evacuation of the hemorrhage is deemed necessary. Finally, surgery may not eliminate the risk of future hemorrhage in these patients. For these reasons, we do not regard the potential for future hemorrhage as a justification for prophylactic surgical treatment.

In some cases, arachnoid cysts may rupture into the subarachnoid space, causing a symptomatic CSF hygroma. None of the patients in our natural history analysis developed symptomatic CSF hygromas during the follow-up interval. Although the spontaneous development of a CSF hygroma resulting from an arachnoid cyst appears to be a rare event, up to 5% of all attempts at surgical cyst fenestration will result in a hygroma that requires additional treatment. We do not believe that prophylaxis against subdural hygroma can be used to justify the treatment of asymptomatic cysts.
Finally, the suggestion that cysts should be treated if they demonstrate evidence of local mass effect on imaging is potentially problematic. Any large intracranial cyst can have the appearance of mass effect on imaging. The appearance of local mass effect, therefore, is too inconclusive to be used as a reliable criterion for selecting patients that require treatment. We do not recommend surgery for stable, asymptomatic cysts in adults, even when there is an appearance of mass effect seen on imaging.

Given the often nonspecific nature of arachnoid cyst symptoms, the potential to overestimate or underestimate symptoms exists in any retrospective analysis of these lesions. Our study methods were designed to be sensitive to the presence of symptoms that may be related to arachnoid cysts. If at any point a treating clinician considered that the cyst could be symptomatic, then we considered it symptomatic for the purposes of our data analysis. In many cases, the symptoms that were attributed to the presence of the arachnoid cyst were nonspecific, making it likely that the cysts were not responsible for the neurological symptoms in at least some cases. For example, in some cases neurological symptoms improved despite the persistence of the cyst. Given the spontaneous resolution of the symptoms, there is reason to doubt that the cyst caused the symptoms in these cases. According to our methods, since these cysts were considered symptomatic by the treating physician, they were considered symptomatic in this study. Therefore, we believe our data are more likely to provide an overestimate rather than an underestimate of symptomatic presentation.

There are several limitations to our study. There is a possible selection bias, as the patients who have undergone MRI evaluation may have a higher rate of intracranial findings than is expected in the general population. Prevalence estimates derived from those undergoing imaging should be considered in this context and should be considered imaging prevalence rather than population prevalence. Referral bias may have influenced our results, as physicians are presumably more likely to refer patients with arachnoid cysts who also have neurological symptoms. We followed the usual convention of dividing middle cranial fossa cysts into categories according to the system proposed by Galassi and colleagues. Although larger cysts are more likely to be considered symptomatic, this phenomenon is not limited to middle fossa cysts, and symptoms from cysts in any location are not predicted by any simple method of size grading. Although the mean duration of imaging follow-up in the natural history analysis was 3.8 years, patients were included as long as a minimum of 6 months of follow-up information was available. The potential for underestimating change exists in any natural history analysis in which the follow-up interval is less than the time period in which potential for change has been noted. This should be considered in any interpretation of our data.

Conclusions

Arachnoid cysts are frequently discovered incidentally on intracranial imaging. Most arachnoid cysts are asymptomatic. The natural history of arachnoid cysts in adult patients selected for nonsurgical treatment is generally benign.

Disclaimer

The authors have no conflicts of interest to report pertaining to the materials or methods used in this study or the findings specified in this paper.

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