Frequency of intracranial aneurysms in patients with spontaneous intracranial hypotension

Clinical article

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Object. Spontaneous intracranial hypotension (SIH) is a significant cause of new-onset daily persistent headache. A generalized connective tissue disorder also involving the intracranial arteries has been suspected in the population with SIH. Therefore, the authors reviewed angiographic studies for the presence of intracranial aneurysms in a group of patients with SIH.

Methods. Magnetic resonance angiography studies of the brain were performed in 93 patients with SIH (mean age 43 years, range 14–86 years) and in 291 controls (mean age 56 years, range 28–78 years).

Results. Intracranial aneurysms were detected in 8 (8.6%) of the 93 patients with SIH (95% CI 2.9%–14.3%). This incidence was higher than in the control population (3 (1.0%) of 291 (95% CI 0%–2.2%; p = 0.0007). In 7 patients the aneurysms were incidental, and in 1 patient SIH developed 5 weeks after an aneurysmal subarachnoid hemorrhage.

Conclusions. In this retrospective case-control study, the frequency of intracranial aneurysms among patients with SIH was significantly higher than in the control population. (DOI: 10.3171/2011.2.JNS101805)

Key Words • cerebral aneurysm • headache • intracranial hypotension • subarachnoid hemorrhage

S PONTANEOUS intracranial hypotension is an increasingly recognized cause of headache, though an initial misdiagnosis remains common.⁷ The headache is typically orthostatic, although numerous other headache patterns have been described as well. Moreover, a wide variety of additional symptoms have been reported, including neck stiffness, diplopia, hearing loss, ataxia, parkinsonism, dementia, and coma. Because the disease often represents a diagnostic challenge, patients with SIH frequently undergo cerebral angiography during evaluation of their headache. An underlying systemic connective tissue disorder is generally suspected in patients with SIH, one possibly affecting the intracranial vasculature.⁴,⁵,⁷,⁸,¹¹,¹³,¹⁵ Therefore, we reviewed the angiographic studies of patients with SIH for the presence of intracranial aneurysms, treatable lesions that, once ruptured, are associated with a high risk of death and disability.

Abbreviations used in this paper: ACoA = anterior communicating artery; ADPKD = autosomal dominant polycystic kidney disease; ICA = internal carotid artery; SIH = spontaneous intracranial hypotension.
the brain had been performed in 95 patients. Intracranial aneurysms were identified in 10 (10.5%) of these 95 patients. However, for the purpose of this study, 2 of these patients were excluded from our analysis because they had suffered spontaneous spinal CSF leakage within 48 hours of a craniotomy for clipping an asymptomatic aneurysm. The mean age of the remaining 93 patients (65 women and 28 men) was 43.2 years (range 14–86 years).

The mean age of the 291 controls (164 women and 127 men) was 54.8 years (range 21–78 years).

Intracranial aneurysms were detected in 8 (8.6%) of the 93 patients with SIH (95% CI 2.9%–14.3%). This rate was higher than in the control population (3 [1.0%] of 291, 95% CI 0%–2.2%; p = 0.0007).

The mean age of the 7 women and 1 man with SIH and intracranial aneurysms was 51.4 years (range 33–63 years; Table 1). None of the patients had a recognized systemic connective tissue disorder, and none had a family history of intracranial aneurysm. Arterial hypertension was present in 1 patient, and 2 patients were current cigarette smokers. There was no evidence of ADPKD on CT in any of the patients, and echocardiography results were normal in the 4 tested patients. In 7 patients, the aneurysms were asymptomatic, and the lesions were detected during evaluation for a headache subsequently attributed to SIH. In 1 patient, orthostatic headaches due to SIH developed 5 weeks after coiling of a ruptured intracranial aneurysm. This patient never underwent lumbar puncture or ventricular drainage. Six patients harbored a single aneurysm, 1 patient harbored 2, and 1 patient harbored 3, for a total of 11 aneurysms. A ruptured 5-mm ACoA aneurysm, an asymptomatic 6-mm ophthalmic artery aneurysm, and an asymptomatic 21-mm superior cerebral artery aneurysm were treated with endovascular coil embolization. The remaining 8 intracranial aneurysms (in 6 patients) all measured < 6 mm and were left untreated. All 6 patients underwent repeat MR imaging or CT angiography between 1 and 7 years after the initial angiographic study. No aneurysm growth or de novo intracranial aneurysm development was detected.

Among the control population, a 52-year-old woman harbored a 4-mm basilar artery and posterior communicating artery aneurysms, a 67-year-old woman harbored a 3-mm ACoA, and a 67-year-old man harbored a 3-mm cavernous ICA aneurysm.

**Table 1: Clinical and radiographic data on the study population***

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs), Sex</th>
<th>Presenting Symptom</th>
<th>MRI Results</th>
<th>Opening Pressure (cm H2O)</th>
<th>Site of CSF Leak</th>
<th>Aneurysm Location</th>
<th>Aneurysm Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61, F</td>
<td>ortho HA</td>
<td>normal</td>
<td>3</td>
<td>thoracic</td>
<td>cav ICA</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>48, F</td>
<td>ortho HA</td>
<td>sagging, meningeal enhancement</td>
<td>5</td>
<td>thoracic</td>
<td>pericallosal</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>46, F</td>
<td>diplopia, ortho HA</td>
<td>normal</td>
<td>3</td>
<td>thoracic</td>
<td>ACoA</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>53, F</td>
<td>ortho HA</td>
<td>normal</td>
<td>6</td>
<td>thoracic</td>
<td>ACoA</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>33, F</td>
<td>ortho HA</td>
<td>meningeal enhancement, sagging</td>
<td>0</td>
<td>no spinal imaging</td>
<td>cav ICA, cav ICA, ophthalmic</td>
<td>2, 3, &amp; 6</td>
</tr>
<tr>
<td>6</td>
<td>59, M</td>
<td>ortho HA</td>
<td>meningeal enhancement, sagging</td>
<td>5</td>
<td>thoracic lumbosacral</td>
<td>superior cerebellar</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>63, F</td>
<td>ortho HA</td>
<td>meningeal enhancement, sagging, pituitary hyperemia</td>
<td>3</td>
<td>thoracic</td>
<td>ICA bifurcation, cav ICA</td>
<td>3 &amp; 3</td>
</tr>
<tr>
<td>8</td>
<td>43, F</td>
<td>ortho HA</td>
<td>meningeal enhancement, sagging</td>
<td>9</td>
<td>lumbar</td>
<td>cav ICA</td>
<td>4</td>
</tr>
</tbody>
</table>

* cav = cavernous; ortho HA = orthostatic headache.

**Discussion**

In this study, 9% of the patients with SIH had intracranial aneurysms, approximately 8 times the incidence in the control population (1.1%) or the reported angiographic frequency in the general adult population (0.5%–2%).

The frequency of intracranial aneurysms in patients with SIH is similar to that in patients with ADPKD (5%–15%),

bicuspud aortic valve (10%),

and coarctation of the aorta (10%).

3 Other systemic disorders that carry an increased risk of intracranial aneurysm development as determined by systematic screening. Patients with ADPKD and a bicuspid aortic valve (unpublished data) may also have an increased risk of SIH, but none of the patients in our study had ADPKD or a known bicuspid aortic valve. Our data support the concept that an underlying systemic connective tissue disorder plays an important role in the development of SIH.

Thunderclap headache, obliteration of the subarachnoid cisterns on CT (pseudo–subarachnoid hemorrhage), and xanthochromia on CSF analysis all are features of SIH and mimic aneurysmal subarachnoid hemorrhage. The increased frequency of intracranial aneurysms in patients with SIH adds to the complexity of diagnosing SIH.

This study has several limitations. Firstly, only about one-third of the patients with SIH underwent MR angiography, and this is a source of potential bias. However, MR angiography was performed during the evaluation of symptoms (usually headache) subsequently attributed to SIH. Spontaneous intracranial hypotension continues to be misdiagnosed at the initial presentation in the majority of patients. Although the exact reasons for obtaining MR angiograms in any particular patient are unknown and MR angiography may have been preferentially used in patients with an increased risk for intracranial aneurysm development, established risk factors—such as family history of intracranial aneurysm, ADPKD, smok-
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ing, and arterial hypertension—were uncommon in our patients with SIH and intracranial aneurysms. Secondly, another limitation of our investigation was our inability to match study and control patients for important risk factors, because age and sex were the only known variables for the controls. However, the frequency of intracranial aneurysms in the control population (1.0%) is within the range reported in the literature (0.5%–2%).1,10,17 Although female sex—a risk factor for intracranial aneurysm development—was overrepresented in the study cohort, the controls were on average more than a decade older than the study patients, and age is the major risk factor for intracranial aneurysm development.

Further investigations of different populations with SIH are required before any recommendations can be made with regard to the advisability of screening for intracranial aneurysms in patients with SIH.

Conclusions

Patients with SIH may have an increased risk of intracranial aneurysm development, possibly reflecting the presence of a systemic connective tissue disorder.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Schievink. Acquisition of data: both authors. Analysis and interpretation of data: both authors. Drafting the article: Schievink. Critically revising the article: Schievink. Reviewed final version of the manuscript and approved it for submission: both authors.

References