ANGIOGRAPHIC FINDINGS IN 130 PATIENTS WITH ANEURYSMAL SUBARACHNOID HEMORRHAGE

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Objectives: To evaluate the distribution and multiplicity of intracranial aneurysms in patients with aneurysmal subarachnoid hemorrhage (SAH) and to characterize the age and sex distribution of these patients.

Methods: We reviewed 130 patients with aneurysmal SAH documented by cerebral digital subtraction angiography (DSA).

Results: The mean age of patients was 45.8 years, with a female to male ratio of 0.68. In 13 (10%) patients there were multiple aneurysms. In 7 (5.4%) patients a giant aneurysm was discovered. Of 143 documented aneurysms found in 130 patients, the most frequent locations were anterior communicating artery (AComA) (29.4%), middle cerebral artery (MCA) bifurcation (21.0%), posterior communicating artery (PComA) (4.7%), internal carotid artery (ICA) bifurcation (9.8%), basilar tip (5.6%), pericallosal artery (5.6%), M1 segment of ICA (excluding ophthalmic and PComA origin) (2.8%), cavernous portion of ICA (2.8%), and ophthalmic artery origin of ICA (2.1%). The least common site for aneurysm was posterior inferior cerebellar artery (PICA) origin (1.4%).

Conclusion: Our findings of the distributions of the aneurysms and the female to male ratio, suggest a contribution of ethnic background, which may need to be considered in diagnosis of these patients.

Keywords: Cerebral aneurysms • cerebral angiography • subarachnoid hemorrhage (SAH)

Introduction

Of all cerebrovascular accidents, 3% are due to subarachnoid hemorrhage (SAH), which is responsible for 5% of deaths due to brain infarctions. The mortality rate (including deaths before admission to hospital) may exceed 50%.1

Intracranial aneurysms are the most common cause of nontraumatic subarachnoid hemorrhage, occurring in 60% – 85% of cases.1, 2, 3, 4 Intracranial aneurysms usually arise from the circle of Willis and its immediate branches.3, 5 The location of an aneurysm is important not only for management of patients, but also because it affects the clinical presentation and prognosis of patients.3

Some avoidable factors such as hypertension, cigarette smoking, and alcohol consumption are contributory causes of aneurysm or hemorrhage.1, 6

The main objective of our study was to analyze age and sex distribution of 130 patients with aneurysmal SAH who attended our center and to determine the site of cerebral aneurysms.

Patients and Methods

We retrospectively reviewed the records of 130 patients with aneurysmal SAH. All patients were evaluated with four-vessel digital subtraction brain angiography in the Medical Imaging Center at Tehran University of Medical Sciences. Cerebral digital subtraction angiography was carried out with bilateral catheterization of both common carotid arteries (2 – 3 cm below the common carotid bifurcation) and catheterization of one or both vertebral arteries. If unilateral vertebral artery injection did not illustrate the contralateral posterior inferior cerebellar artery (PICA), we
performed bilateral vertebral injections. Both common carotid arteries were injected in lateral, oblique, and anteroposterior (AP) views. Both lateral and frontal views of the vertebrobasilar complex were taken. As deemed necessary, additional discretionary views were obtained (e.g. transorbital, basal, and reverse oblique) during the angiography, to elucidate overlapping vessels or further clarification, based on the region of interest. Angiography equipment included a GE-DEX DSA device, used at 1200 mA and 140 kVP. Catheters utilized for angiography included 4 – 7 French diameters, including multipurpose, Simmons, Headhunter, and MANI catheters. Data analyses were performed with SPSS version 10. Confidence intervals (95%), and statistical type I error were set to 95% and 5%, respectively.

Results

Of 130 patients studied, 77 (59.2%) were males and 53 (40.8%) were females. The mean ± SD age of patients was 45.7 ± 14.1 years (42.0 ± 14.7 for males and 50.0 ± 12.1 for females; \( P = 0.001 \)). The age distribution of our patients is demonstrated in Figure 1.

Altered mental status, manifested as reduced consciousness, was noted in 25.4% of our patients. Nausea and vomiting was seen in 30% of our patients. Multiple aneurysms were noted in 13 patients—all of whom had two aneurysms. There were a total of 143 aneurysms found in 130 patients.

The rate of multiple aneurysms was 9.6%. Sixty-one percent of multiple aneurysms were detected ipsilateral to the presenting aneurysm, while 23% were found in the contralateral homonymous artery. Four fusiform (3.1%) and eight (6.2%) giant aneurysms were demonstrated. Coexisting arteriovenous malformations (AVM) were demonstrated in two patients. Ten (7% of the total) aneurysms were found in posterior circulation and 133 (93%) aneurysms were detected in the territory of anterior circulation (Table 1).

Discussion

Although most previous reports have demonstrated the mean age for a symptomatic aneurysm to be 50 – 60 years or higher, in our study, patients had a mean age of 45.7 years with the majority of patients in the 40 – 50 year age range. In the existing literature, the majority of cases of aneurysm present after the age of 50, with a female to male ratio of ≥1.3. In most previous reports, the majority of presenting females are in their 6th decade of life with most males presenting in their 5th decade. Several reports demonstrated that most patients under the age of 50 with subarachnoid hemorrhage, tend to be male. The high proportion of males in our study may partially explain the low mean age for our patients as compared with other reports. Notably, the average age of the females in the study (50 years), is considerably lower than that previously reported. The high proportion of males in our study (59.2%) is in distinct contrast with the greater incidence of aneurysms in females in other reports—female to male ratio of 1.3. Due to varying cultural and social factors in our population, it is possible that the epidemiological relationships between hypertension, cigarette smoking, and alcohol consumption may partially explain the discrepancies between this study and the others.

The pattern of anatomic distribution demonstrated in the current study is consistent with that previously reported—93% in anterior circulation and 7% in posterior circulation. We found a similar distribution of aneurysm in the circle of Willis as compared to others, with 35.0% of aneurysms located in the anterior cerebral artery and most anterior circulation aneurysms manifesting as anterior communicating artery aneurysms. Further assessment of the internal carotid artery distribution of aneurysms, however, revealed that although the total incidence of 32% is similar to that of previous reports, the anatomical distribution along the internal carotid artery differs slightly. Distinctively, the number of aneurysms in posterior communicating artery was less than 15%.
of all of the presenting intracranial aneurysms, which is in contrast to the previously reported rates of 25% – 30%.

We found a greater number of aneurysms located in internal carotid artery bifurcation than it would ordinarily be expected. Although we do not have a causal explanation for this finding, it would evoke epidemiological and ethnic factors as hypothetical contributors.

We found a similar incidence of aneurysm formation in the middle cerebral artery and its branches (25.8%) as compared to previous reports (18% – 27%). The majority (20%) of aneurysms of the middle cerebral artery of our patients were located in the bifurcation which is in keeping with previously reported incidence of 13% – 20%.

Regarding the incidence of basilar aneurysms, the incidence of 6% is similar to previous reports.

In our population, less than 10% of patients had multiple aneurysms; in other studies this has ranged from 5% – 30%. The total number of patients with multiple aneurysms in this study however small in contrast to some studies, was demonstrated to be unilateral in 61% of patients. Furthermore, 9% of the aneurysms have been reported to be coexistent with arteriovenous malformations; the reported rate of 1.4% in our series is lower than it would be expected.

There are significant differences regarding the incidence and site of aneurysms in patients with aneurysmal subarachnoid hemorrhage in Iranian patients as compared to preexisting non-Iranian population-based studies. The specific findings of increased male preponderance and a younger age of presentation are notable. Although contributory factors include genetic and ethnic factors, additional sociological risk factors such as smoking, hypertension, and alcohol consumption may be existed.

Since this study is an internal cohort comparison, it is quite possible that the lower age of presentation is due to the greater relative incidence of subarachnoid hemorrhage in males in this population. An additional notable finding is the lower-than-expected rate of posterior communicating artery aneurysms.

Table 1. Anatomic distribution of aneurysms.

<table>
<thead>
<tr>
<th>Main territory</th>
<th>Total number(%) in this territory</th>
<th>Anatomic location</th>
<th>Total number in this anatomic location</th>
<th>% among all aneurysms</th>
<th>% in this vascular distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior circulation</td>
<td>133(93% of all)</td>
<td>ACA¹</td>
<td>50(34.9%)</td>
<td>ACommA⁴</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Horizontal Portion of ACA</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICA²</td>
<td>46(32.2%)</td>
<td>ICA bifurcation</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCommA⁵</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intracavernous segment</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ophthalmic A origin</td>
<td>3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Supra clinoid portion</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCA³</td>
<td>37 (25.8%)</td>
<td>MCA bifurcation</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Horizontal portion of MCA</td>
<td>7</td>
</tr>
<tr>
<td>Posterior circulation</td>
<td>10 (7% of all)</td>
<td>Basilar A</td>
<td>8(5.6%)</td>
<td>Basilar tip</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vertebral A</td>
<td>2(1.4%)</td>
<td>PICA</td>
<td>2</td>
</tr>
</tbody>
</table>

¹ = anterior cerebral artery; ² = internal carotid artery; ³ = middle cerebral artery; ⁴ = anterior communicating artery; ⁵ = posterior communicating artery.

References

4. Osborn AG. Intracranial aneurysms. In: Osborn AG,


