Size, location, and multiplicity of ruptured intracranial aneurysms in the Hong Kong Chinese population with subarachnoid haemorrhage

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Objective To review the pattern of ruptured intracranial aneurysms in terms of size, location, and the prevalence of multiple aneurysms in the Hong Kong Chinese population with subarachnoid haemorrhage.

Design Retrospective study.

Setting Three public hospitals in Hong Kong.

Patients A total of 267 Chinese patients with subarachnoid haemorrhage from ruptured intracranial aneurysms between July 1998 and June 2002 were reviewed retrospectively.

Results The patients had a mean age of 59 (range, 13-96) years, with a female-to-male ratio of 2:1. Concerning the age at presentation, males presented with ruptured intracranial aneurysms at a younger age (P=0.001) than females. Ruptured aneurysms were more commonly located in the anterior than posterior circulation (84% vs 16%). The posterior communicating artery (26%) and anterior communicating artery (22%) were the most common sites of rupture. As a whole, 64% of the aneurysms had a size of 5 mm or less. The anterior communicating artery had a higher proportion with a size of 5 mm or less compared to other locations (P<0.05). In this cohort, the prevalence of multiple aneurysms was 17%. There was no significant difference in the prevalence of multiple aneurysms between men and women (P=0.30). In patients with multiple aneurysms, the sizes of ruptured aneurysms were greater than those of the largest unruptured aneurysms (P<0.001). When compared with the group with single aneurysms, patients with multiple aneurysms had a smaller proportion of small aneurysms, sized 5 mm or less (P<0.05).

Conclusions The pattern of ruptured intracranial aneurysms in the Hong Kong Chinese population was different from western and Japanese populations. Although the distribution of locations for ruptured aneurysms was similar, Hong Kong Chinese had a larger proportion of small aneurysms sized 5 mm or less. The prevalence of multiple aneurysms in Hong Kong is comparable to that in the Japanese population, but lower than that in the western populations.

Introduction

Ruptured intracranial aneurysm is the most common cause of subarachnoid haemorrhage (SAH), and can cause significant morbidity and mortality. The incidence of SAH in western populations is about 10 to 15 per 100 000 persons per year. Understanding of the pattern of intracranial aneurysms is helpful in the management of this disease. The epidemiology of intracranial aneurysms in western populations is well reported in the literature, and includes the size, location, and prevalence of multiple aneurysms among patients with ruptured intracranial aneurysms. Many studies even attempted to determine whether there is a critical size at which an aneurysm was likely to rupture and thus warrant treatment. Unlike Caucasian and Japanese populations, few studies describing the
pattern of intracranial aneurysms in the Chinese population have been published.\textsuperscript{14,15} The purpose of our study was to review the pattern of ruptured intracranial aneurysms, in terms of size, location, and the prevalence of multiple aneurysms in a Hong Kong Chinese population. We hope the results will lay the foundation for future studies regarding the pattern of intracranial aneurysms in the Chinese population.

Methods
This was a retrospective study of Chinese patients with ruptured intracranial aneurysms between July 1998 and June 2002, which involved admissions for spontaneous SAH. These patients were admitted to three neurosurgery centres (Prince of Wales Hospital, Queen Elizabeth Hospital, and Queen Mary Hospital) in Hong Kong; SAH was diagnosed by brain computed tomography. They all had digital subtraction angiography (DSA) to look for intracranial aneurysms. One Chinese patient had no aneurysm detected with DSA. Data pertaining to 13 patients of other ethnic groups were excluded from this series. Therefore, 267 Chinese patients with ruptured intracranial aneurysms (281 admissions for spontaneous SAH) were eventually included in the series. In each case, the size and location of the ruptured aneurysm were recorded (Table 1). The size of each aneurysm was measured by DSA. The largest diameter was measured through the long axis of the aneurysm. When multiple aneurysms were present, the one responsible for rupture was determined by the computed tomographic SAH pattern, angiographic findings, or operative findings.

Results
Of the 267 patients included in our series, data pertaining to the age and size of the aneurysm were missing in a female patient. The patients in our series ranged in age from 13 to 96 years with a mean age of 59 years (standard deviation [SD], 14 years). There was a 67% (178/267) female predominance (Table 2); in women, the mean age was 61 (SD, 14) years, whereas in the 89 men it was 55 (SD, 12) years. Males presented with ruptured intracranial aneurysms at a younger mean age than females (mean age difference, 6 years; 95% confidence interval [CI], 3-10 years; \( P=0.001 \)). There was no significant difference in the size of the ruptured aneurysms (\( t \) test, \( P=0.21 \)) in men (mean size, 6.3 mm) and women (mean size, 5.6 mm).

Most of the aneurysms (224/267, 84%) were located in the anterior circulation. The two most common sites of rupture were the posterior communicating artery (70/267, 26%) and anterior communicating artery (60/267, 22%). Only 16% (43/267) of the aneurysms were in the posterior circulation; 60% (161/267) were in the anterior circulation. The two most common sites of rupture were the posterior communicating artery (26% [70/267]) followed by anterior communicating artery (22% [60/267]).

<table>
<thead>
<tr>
<th>Location*</th>
<th>Size (mm)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior circulation (84%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCoM A</td>
<td>43 20 5 2 0 0 70</td>
<td></td>
</tr>
<tr>
<td>ACoM A</td>
<td>45 14 1 0 0 0 60</td>
<td></td>
</tr>
<tr>
<td>MCA</td>
<td>24 11 2 2 0 1 40</td>
<td></td>
</tr>
<tr>
<td>ICA</td>
<td>14 5 0 3 0 1 23</td>
<td></td>
</tr>
<tr>
<td>Ophtha</td>
<td>11 4 2 1 1 1 19</td>
<td></td>
</tr>
<tr>
<td>ACA</td>
<td>8 3 0 0 0 0 11</td>
<td></td>
</tr>
<tr>
<td>Posterior circulation (16%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA</td>
<td>8 6 0 1 0 0 15</td>
<td></td>
</tr>
<tr>
<td>VA</td>
<td>1 6 0 0 0 0 7</td>
<td></td>
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<tr>
<td>PCA</td>
<td>6 0 1 0 0 0 7</td>
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<tr>
<td>PIC A</td>
<td>5 1 1 0 0 0 7</td>
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<tr>
<td>SCA</td>
<td>3 2 0 0 0 0 5</td>
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<tr>
<td>AICA</td>
<td>2 0 0 0 0 0 2</td>
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</table>

\( ^* \) PCoM A denotes posterior communicating artery, ACoM A anterior communicating artery, MCA middle cerebral artery, ICA internal carotid artery (including any aneurysm located in the intracranial portion of ICA), Ophtha ophthalmic artery, ACA anterior cerebral artery, BA basilar artery, VA vertebral artery, PCA posterior cerebral artery, PI CA posterior inferior cerebellar artery, SCA superior cerebellar artery, and AICA anterior inferior cerebellar artery

\( ^\# \) Missing data for one case

TABLE I. Size and location of ruptured intracranial aneurysms

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the basilar artery being the most frequent site of rupture (15/267, 6%) in this region.

The majority of the ruptured aneurysms were small. In all, 91% (242/266) of the aneurysms were 10 mm or less, whilst 64% (170/266) were 5 mm or less. Only 1% (two patients) had giant aneurysms (sized >25 mm). Statistical analysis showed that rupture at the anterior communicating artery involved a higher proportion of aneurysms of size 5 mm or less compared to all other locations (Z test, P<0.05).

The point prevalence of multiple aneurysms was 17%; of the 267 patients, 45 had two or more aneurysms diagnosed (Table 3). There was no significant difference in the proportion of multiple aneurysms in men and women (Pearson Chi squared test, P=0.30).

Concerning the location of ruptured aneurysms, the majority were located in the posterior and anterior communicating arteries, which is similar to the pattern reported in western and Japanese populations. Such findings are also consistent with previous literature from Hong Kong and Taiwan, which revealed a high proportion of anterior and posterior communicating artery aneurysms in the Chinese population.

As for the size of ruptured aneurysms, 64% (170/266) of the Chinese patients with SAH had small ruptured aneurysms (sized ≤5 mm). Previous study in the Chinese population also demonstrated a high proportion of such small aneurysms of size 5 mm or less. This pattern was different from that in western and Japanese populations, in whom it was reported that only around 25 to 35% of ruptured intracranial aneurysms had a size of 5 mm or less. Our series demonstrated a significantly larger proportion of aneurysms of 5 mm or less (170/266, 64%) than that reported in other populations. The point prevalence of giant aneurysms in our series (2/266, 1%) was similar to that reported in the Japanese population (1%). However, the point prevalence of giant aneurysms in our Chinese cohort was significantly less than the figure of approximately 4% published in literature from the West. The observed difference in the size of ruptured aneurysms among racial-ethnic groups can be due to genetic differences. Nevertheless, in contrast to Caucasian populations, the Japanese share the same Mongoloid origin with Chinese. Therefore, other factors, such as lifestyles...
and other environmental factors, may contribute to these differences.

Notably, the percentage of small aneurysms (especially those ≤5 mm) rupturing in the anterior and posterior communicating arteries was high. In our series, aneurysms of anterior communicating artery were significantly associated with a small size of 5 mm or less compared to those in other locations. This can be explained by the relatively smaller thickness and diameter of the anterior communicating artery, which limits the size of the aneurysm at the time of rupture.

Many series, including our own, have demonstrated that the majority of ruptured aneurysms are less than 10 mm in diameter. Some authors therefore argue that the risk of rupture for small aneurysms was high. However, we cannot determine the risk of rupture of small aneurysms unless we know the prevalence of small unruptured aneurysms. Screening for asymptomatic cerebral aneurysms is not routinely undertaken in Hong Kong. Our study simply examined ruptured aneurysms in a population with an unknown number of unruptured aneurysms. Furthermore, we do not know how many patients with ruptured aneurysms did not seek medical attention. Hence, the risk of rupture of those unruptured aneurysms cannot be extrapolated from the data of patients with ruptured aneurysms.

The point prevalence of multiple aneurysms in our series (45/267, 17%) was comparable to that in the Japanese population reported as around 15%, whilst some literature describing western populations reported it to be 30%. Many studies have listed the risk factors of multiple aneurysms, such as smoking, hypertension, and family history of cerebrovascular diseases. Thus, the difference in the prevalence of multiple aneurysms may be related to the prevalence of risk factors in various populations. In our series, there was no significant difference in the proportion of multiple aneurysms between men and women, which is contrary to the general finding that female gender is a risk factor for multiple aneurysms. However, as our series did not consider other risk factors for multiple aneurysms, a confounding effect cannot be excluded.

Concerning the size of multiple aneurysms, not surprisingly aneurysms of larger diameter are more likely to rupture. Our study also revealed that a larger proportion of patients had small aneurysms among those with single than multiple aneurysms. We speculate that the walls of aneurysms in patients with a single aneurysm are weaker than in patients with multiple aneurysms. Therefore, they may rupture before they become large or the rupture occurs before eruption of any new aneurysm.

Conclusions

Our study reveals the pattern of ruptured intracranial aneurysms, in terms of size, location, and the point prevalence of multiple aneurysms in a Hong Kong Chinese population. It helps to lay the foundation for future studies on intracranial aneurysms in the Chinese population. It also demonstrates that the pattern of ruptured intracranial aneurysms in Hong Kong Chinese population differed from that in western and Japanese populations. Although the locational distribution of ruptured aneurysms was similar, the Hong Kong Chinese population had a larger proportion of small aneurysms of size of 5 mm or less. The prevalence of multiple aneurysms in Hong Kong is comparable to that in the Japanese population, but lower than that in western populations.

References


