The natural history of aneurysms and arteriovenous malformations

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The authors summarize the findings of previous studies relating to the natural history of aneurysms and arteriovenous malformations (AVM's). Ruptured aneurysms have their highest rate of rebleeding on Day 1, and at least 50% will rebleed during the 6 months after the first hemorrhage. Thereafter, the rate drops to at least 3% a year. This is the same rate as seen in anterior and posterior communicating artery aneurysms treated by anterior cerebral artery clipping and carotid ligation; these operations provide immediate protection but do not result in long-term diminution of the risk of rebleeding. Patients with unruptured incidental and unruptured multiple aneurysms rebleed at a rate of 1% per year, as do patients with subarachnoid hemorrhage of unknown etiology. The risk of rebleeding for AVM's is 3% a year.

KEY WORDS cerebral aneurysm • arteriovenous malformation • natural history • early surgery • subarachnoid hemorrhage

This report is based on material presented at a breakfast seminar at the Annual Meeting of the American Association of Neurological Surgeons in April, 1984. The data were derived from two principal overlapping series: namely, the experience collected at the Atkinson Morley's Hospital, Wimbledon, England, and the Cooperative Aneurysm Study. In addition, reference was made to a study under the direction of one of us (N.F.K.) entitled The International Cooperative Study on the Timing of Aneurysm Surgery, and to an analysis of incidental aneurysms in Charlottesville, Virginia.

It is highly unlikely that these studies will ever be repeated and now, some 24 years after the first publication associated with that cooperative effort, it seems appropriate to briefly summarize what has been learned about one important thrust of the work: namely, the natural history of aneurysms and arteriovenous malformations. We have summarized the findings of these reports and present conclusions, giving references to the original work, which may be examined for further details.

Summary of Findings

The case histories of patients admitted to the Atkinson Morley's Hospital, Wimbledon, England, on the service of Wylie McKissock, Alan E. Richardson, Lawrence Walsh, and Valentine Logue were reviewed by two of the authors (J.A.J. and H.R.W.) in 1960, 1973, and 1978. A series of articles has been published in association with Richardson, and the specific details of the patient population may be found in those papers.

The Cooperative Aneurysm Study was the first international effort to study cerebrovascular disease. A description of its patient population and protocols can be found in the report edited by Sahs et al. Other publications have also been based upon the study findings. Further information has been gained through a new international cooperative study, which has given us important data on the rate of early rebleeding related to cerebrovascular disease.

Figure 1 and Table 1 summarize the information that has been obtained. There is often more than a single case history of aneurysmal rebleeding.
reference following the rebleed rate assigned in Table 1, but disagreement among different studies was small and the reader may refer to the original work in order to study the data. Figure 1 illustrates the high rate of rebleeding initially seen. In fact, there is no peak at 7 days as was originally thought. Perhaps this early interpretation was due to inability in the past to distinguish between rebleeding and spasm. The rate rapidly diminishes so that at 15 days the chance of rebleeding is 30%. It reaches a steady state at about 5% between 40 and 90 days after the initial hemorrhage and continues at about 3% for up to 15 years (Fig. 1).

Unruptured aneurysms are considered to be of two types: those found incidentally on an arteriogram performed to detect some other disease, and those found in association with a ruptured aneurysm; that is, in cases of multiple aneurysms. The rate of hemorrhage for both types is 1% a year.

![Graph relating the interval from the day of the first hemorrhage to the chance of rebleeding. There is a rapid fall-off in the chance during the first 3 weeks and then a much slower reduction between Day 60 and 6 months. After 6 months the rate is approximately 3% per year.](image)

**TABLE 1**

<table>
<thead>
<tr>
<th>Rate of rebleeding for aneurysms and AVM's</th>
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</thead>
<tbody>
<tr>
<td><strong>Cerebrovascular Disease</strong></td>
</tr>
<tr>
<td>ruptured aneurysms</td>
</tr>
<tr>
<td>early (&lt; 6 mos)</td>
</tr>
<tr>
<td>late (&gt; 6 mos)</td>
</tr>
<tr>
<td>untreated aneurysms</td>
</tr>
<tr>
<td>incidental findings</td>
</tr>
<tr>
<td>multiple aneurysms</td>
</tr>
<tr>
<td>treated aneurysms</td>
</tr>
<tr>
<td>early (&lt; 6 mos)</td>
</tr>
<tr>
<td>late (&gt; 6 mos)</td>
</tr>
<tr>
<td>SAH of unknown etiology</td>
</tr>
<tr>
<td>ruptured AVM</td>
</tr>
</tbody>
</table>

* SAH = subarachnoid hemorrhage; AVM = arteriovenous malformation.
† Rebleeding rate for posterior communicating artery aneurysms treated by carotid ligation, and anterior communicating artery aneurysms treated by anterior cerebral artery clipping.

It has been found that carotid ligation for ruptured posterior communicating artery aneurysms and anterior cerebral artery clipping for ruptured anterior communicating artery aneurysms have the same effect. They both improve the short-term prognosis, reducing the rate of rebleeding during the first 6 months from the expected 50% to 3%, but they do not change the long-term prognosis. In other words, if these lesions are not removed from the circulation, they continue to rebleed at a rate of 3% a year.

Subarachnoid hemorrhage of unknown etiology carries an agreeably low rate of rerupture of 1% a year. More detailed information will be found in the review by Nishioka, et al. Arteriovenous malformations present a complex problem that is best summarized by assuming that the rate of rebleeding is 3% a year.

References

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