SUBARACHNOID HEMORRHAGE: PROGNOSTIC FACTORS

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The problem of spontaneous subarachnoid hemorrhage has been receiving much attention during the past few years. This has been particularly true of aneurysms as the chief etiological agent. Prognosis in the cases of ruptured intracranial aneurysm seems to be well established. The present study is concerned chiefly with those cases in which the diagnosis of aneurysm could not be made by conventional techniques.

Statistical surveys emanating from various clinics must be evaluated with full knowledge of certain variables. A disease that may be suddenly fatal has a certain natural selectivity which prevents a large diagnostic clinic from seeing its proportionate share of the acute problem. The small hospital with limited facilities cannot in many instances arrive at a definitive diagnosis. The philosophy of the community physician is also a major factor in the diagnosis of this disease and finally, the attitude of the neurosurgeon and his past experience will influence his handling of a given case. Our statistics can reflect, therefore, only those of our medical community.

During the past 10 years 151 patients with spontaneous subarachnoid hemorrhage have been admitted to the Hartford Hospital. There were 70 cases of verified aneurysms and 81 cases in which no aneurysm was demonstrated. These figures seem somewhat disproportionate to other series1,2,9 and may be ascribable to technical difficulties with angiographic techniques in the early cases as well as to a number of aged patients in whom angiography was deemed ill advised. Recent figures would indicate a somewhat higher percentage of subarachnoid hemorrhages with demonstrable aneurysms.

Little has been reported about the fate of patients with subarachnoid hemorrhage in whom no definite evidence of an aneurysm was found. With this in mind a follow-up study was made of the 81 such patients in our series to learn whether they had survived an appreciable time and if not, whether they had died as a result of subarachnoid hemorrhage.

It was possible to obtain a satisfactory follow-up report, either by direct contact with the patient or more rarely by inquiry of the family physician, in all but 10 of the 81 cases (Table 1). The latest reports have all been obtained within the past 6 months. There were 52 patients still alive from 1 to 10 years following the hemorrhage, and in general they were doing well. There were 19 deaths. The over-all mortality in this group of spontaneous subarachnoid hemorrhage is about 27 per cent which compares very favor-

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ably with the known mortality of 50 per cent in cases of aneurysm in the first year after hemorrhage.3-5,8,10

Admittedly, the follow-up period in some of these cases is too short to give accurate statistics in terms of life expectancy; nevertheless, a significant number of patients have survived a surprisingly long time. Eighteen have been followed for over 5 years and have had no further difficulty.

The presence or absence of aneurysm had to be established by existing clinical standards. We were primarily interested in those cases in which an aneurysm was not demonstrated so that no practical therapy could be instituted other than the usual routine of bed rest and repeated lumbar punctures. We did not include those cases in which the patients were admitted in extremis and an aneurysm was found at autopsy, even though in certain of these angiography had not revealed the source of bleeding. All but 6 patients included in this series had angiograms; most of them had bilateral carotid angiograms, a few had vertebral as well, and in some of the earlier cases only a unilateral angiogram was done on the side indicated by focal neurological signs (Table 2). It seems unlikely that repeated angiograms will subsequently reveal the abnormality as evidenced by the few cases in which these were done. On the basis of these studies it would seem that in the face of a spontaneous subarachnoid hemorrhage, angiography should be attempted. If it be negative, the prognosis in a given case is significantly better than in the case in which an aneurysm is demonstrated. The latter, untreated, results in a forbidding mortality.

The mortality statistics are also worthy of consideration. All but 1 of the deaths occurred within 1 year. All were caused by repeated hemorrhage except 1, and in this case the patient had a known hypernephroma of the kidney with metastasis and presumably his subarachnoid hemorrhage was

### TABLE 1

*Summary of end results*

<table>
<thead>
<tr>
<th>Result</th>
<th>1-5 Yrs.</th>
<th>Over 5 Yrs.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alive</td>
<td>34</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>Dead</td>
<td>Under 1 yr.</td>
<td>Over 1 Yr.</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>71</td>
</tr>
</tbody>
</table>

### TABLE 2

*Angiography*

<table>
<thead>
<tr>
<th>Angiography</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral carotid and vertebral</td>
<td>4</td>
</tr>
<tr>
<td>Bilateral carotid</td>
<td>30</td>
</tr>
<tr>
<td>Unilateral carotid</td>
<td>12</td>
</tr>
<tr>
<td>None</td>
<td>6</td>
</tr>
</tbody>
</table>
secondary to a metastatic lesion though he died of pulmonary metastasis. While but few postmortem examinations were performed in this group, there were 3 cases in which no aneurysm was demonstrated at autopsy though extensive subarachnoid and intracerebral hemorrhages were present (Table 3). This is not too surprising in view of the experience of others.\textsuperscript{7} There seems little doubt that in most of these cases there were aneurysms that had failed to fill in routine angiography, and the short life-expectancy seems to confirm this impression.

The problem of aneurysms per se has been deliberately withheld as has the examination of angiomas and they will be the subject of a later communication. Aneurysms are not necessarily fatal though they carry a high mortality. More refined medical and surgical technique will decrease this mortality in time. This is particularly true in the case of aneurysms not diagnosed by present techniques. The 1 case in which an aneurysm was demonstrated post mortem proved to be an internal carotid aneurysm in a young male which could have been treated with reasonable chance of success had the lesion been diagnosed upon admission.

The role of hypertension has been difficult to evaluate in this series because many patients were admitted in a state of hypertension caused by the cerebral insult rather than antecedent factors. However, when a rigid criterion was established in which hypertension had been determined as a clinical entity prior to hemorrhage there were 7 patients who survived the hemorrhage: 2 are still alive and doing well 5 years later, 1 is still doing well 3 years later, and 4 died. The statistical difference here does not seem significant except that there were relatively few patients with hypertension in the series. This may well be a false evaluation since many such patients may have died at home or a diagnosis of thrombosis rather than subarachnoid hemorrhage may have been made.

The morbidity in terms of neurological deficit is another facet of this problem that has seldom been dealt with in the literature. It is of little benefit to the patient to have him survive only to live a vegetative existence because of profound neurological deficit. In the group of survivals in this series, 45 patients have resumed normal life and show no residuals at all.
Four patients without neurological deficit are under medical care for hypertension but all carry on normal activity within the limits of their hypertension. Two patients have sufficient deficit to make normal life impossible but both are cared for at home without special facilities. One patient had had a psychotic episode requiring institutionalization. This antedated the hemorrhage and reappeared 2 years following the bleeding episode. The 10 cases in which no follow-up report could be obtained represent a problem. Two of these patients had such neurological deficit at discharge that they were transferred to nursing homes where contact with them was lost. The remainder were either from distant cities or of such economic status that they were impossible to locate by usual methods.

The previous statistics would seem to imply that upon occurrence of a spontaneous subarachnoid hemorrhage, a careful search should be made to determine the presence or absence of demonstrable aneurysm as the etiological agent. Should it be impossible to demonstrate a causal lesion, the prognosis from the standpoint of hemorrhage is fairly good and if the person survives 1 year the prognosis is excellent. This may be one factor that explains divergent statistics reported previously.1,6 It thus becomes obvious, in regard to prognosis, that series treating subarachnoid hemorrhage as a gross entity are by no means comparable to series of proven berry aneurysms.

In the present study there was no predilection for any age group. Most of the patients were adults (20–60 years) and there was no tendency for cases to predominate in a specific decade. Nor was there any major difference in age groups of those who survived and those who died. Comparing this group with a series of 70 verified aneurysms, the only difference seems to be that in cases of aneurysm the greatest number fall into the 30–40 age group (Fig. 1). It is interesting that all of the children included in this series have

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**Fig. 1. Age incidence.**
done extremely well. One child who had a serious neurologic disability secondary to the hemorrhage has had a complete remission and is now participating in all activities in college and is actually doing ballet.

Three patients among the 52 survivors had recurrent hemorrhage; however, they recovered and have lived up to 5 years following the second attack. Presumably these, too, have aneurysms that are either microscopic or unlocalizable by angiographic techniques. The etiological factors in these subarachnoid hemorrhages are not clear but we have assumed that in most instances they represent aneurysms that have developed sufficient clot to prevent their filling with contrast medium at angiography and usually go on to complete fibrotic occlusion. A few must either hemolyze or simply fail to fill with the contrast medium during the original study either because of poor timing or the position of the aneurysm. We must also be aware of those lesions that fill only by vertebral angiography. Technical difficulties and fear of complications as well as a feeling that most aneurysms of the posterior fossa do not lend themselves to surgical treatment have tended to reduce the number of vertebral angiograms done.

**SUMMARY**

1. Eighty-one cases of spontaneous subarachnoid hemorrhage were reviewed in which no diagnosis of ruptured aneurysm could be made.
2. The over-all mortality was about 27 per cent.
3. The statistics would indicate that in cases in which no aneurysm could be demonstrated, the prognosis was good. If survival exceeded 1 year, it was excellent, with almost 100 per cent recovery.
4. There are some aneurysms that are not identifiable by standard angiography.

**REFERENCES**