Ruptured Intracranial Aneurysms—The Role of Arterial Spasm*

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In a recent paper the authors discussed the findings of postoperative angiography carried out routinely on patients with ruptured intracranial aneurysms. It was felt that arterial spasm was one of the chief reasons for postoperative morbidity and mortality, and in this paper the problem is considered further with regard to cause and effect. Attention is given also to earlier manifestations of arterial spasm, whether operation was undertaken or not.

It has been suggested that vasospasm is an optical illusion. However, when a vessel, previously shown to be of normal calibre, later appears thread-like in two or more projections (Figs. 1 and 2), it is hard to accept that this could be attributed to a physical phenomenon such as laminar flow of contrast material in the artery.

Taveras accepted the occurrence of spasm but considered it to be the result of the introduction of radiopaque contrast material into an artery already irritated by some other cause. There are several points against this theory. (1) This effect is seldom seen in postoperative angiograms of patients who have had tumours removed. In such patients the arteries may have been injured and blood will be present in the subarachnoid space. In cases of ruptured aneurysms these are two of the conditions that might predispose arteries to spasm. (2) The substitution of Thorotrast, which is generally accepted as being nonirritating to vessels, for contrast media containing iodine, does not alter the appearances. In a series of radiographs showing spasm the contrast material appears to be dammed back so that any particular artery is not visualized until a stage later than usual. This implies that the vessels were constricted and the blood flow was decreased before the contrast medium ever reached the brain. As was shown in the previous paper, and discussed later herein, clinical signs and symptoms appropriate to the vessels involved are usually present when spasm is demonstrated.

Material

On the basis that spasm does occur and that it is not a result of angiography, the records of 175 patients have been analyzed with regard to any parameter that might be relevant in considering its cause and effect.

Of these patients, 47 never came to operation, and postoperative angiography was not carried out in 45 of those who were treated surgically (Table 1).

Pre-Operative Spasm

It is possible that the causes of pre-operative and postoperative spasm may be different, so the two must be considered separately.

Seventy patients showed evidence of arterial narrowing at some stage prior to operation and 105 did not. Fletcher et al. suggested that the decades beyond 50 were the least dangerous for the development of spasm, but our figures do not confirm this, and the average age in the 2 groups is practically the same. Using Botterell's classifi-

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<thead>
<tr>
<th>Material</th>
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<tbody>
<tr>
<td>Angiography, no operation</td>
<td>47</td>
</tr>
<tr>
<td>Angiography, operation, no angiography</td>
<td>45</td>
</tr>
<tr>
<td>Angiography, operation, angiography</td>
<td>83</td>
</tr>
<tr>
<td>Total</td>
<td>175</td>
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TABLE 1
cation the average grade appeared irrelevant, as did the distribution of sex. In the group with spasm, there was a slightly higher average number of haemorrhages per patient (Table 2).

A recent paper by Stornelli and French suggested that arterial spasm was seen only in association with raised intracranial pressure and systemic hypertension. In the cases under review the cerebrospinal-fluid pressure was not measured routinely, as lumbar puncture had been carried out usually in other hospitals prior to admission to our unit and frequently was not repeated. However, in the presence of a haematoma the pressure can be presumed to be raised and there was

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**Fig. 1.** Lateral and anteroposterior view of arterial phase of angiogram before operation.

**Fig. 2.** Radiographs in same case as in Fig. 1, 7 days after clipping of posterior communicating aneurysm, showing intense spasm of distal portion of carotid siphon and its branches.