Effect of Common Carotid Ligation on Size of Internal Carotid Aneurysms and Distal Intracarotid and Retinal Artery Pressures*

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Previous investigators have demonstrated significant changes in aneurysms of the internal carotid artery after ligation of the common carotid artery.1,5,8,10,13,15,21 Follow-up carotid arteriography in 26 patients treated with this method in our clinic revealed a significant decrease in aneurysm size in 14, non-visualization of the aneurysm in 9, and no change in size in 3 cases.15 Since these cases were reported, we have had 32 additional patients who have been treated by common carotid ligation for an aneurysm of the internal carotid artery. They have undergone follow-up studies which include repeat carotid arteriography and determination of the residual intravascular and retinal artery pressures. In this paper, we have analyzed the changes that occur in the aneurysm and in the intravascular and retinal artery pressures following carotid ligation.

Material

From November, 1957, through October, 1965, a total of 82 patients have been readmitted to the hospital in order to carry out repeat carotid arteriography and measurement of the distal intracarotid and retinal artery pressures. Each had had an aneurysm of the internal carotid artery treated by gradual ligation of the common carotid artery using a Crutchfield clamp. In 58 of the 82 patients, satisfactory follow-up carotid arteriography was accomplished. These 58 patients formed the basis for this report.†

The patients were divided into 3 groups according to the location of the aneurysm on the internal carotid artery.

Group 1. The aneurysm was situated at the bifurcation of the internal carotid or

at the site of origin of the posterior communicating artery—41 patients.

Group 2. The aneurysm was located between the posterior communicating artery and cavernous sinus—12 patients.

Group 3. The aneurysm was situated in the cavernous sinus or carotid canal (extradural)—5 patients.

Thirty-eight of the patients were women and 20 were men. Mean age of the women and men was 46.4 and 45.0 years, respectively. Forty-six patients had experienced one or more subarachnoid hemorrhages verified by lumbar puncture prior to surgical treatment. In 12 patients the aneurysm had not ruptured. The most common presenting clinical finding in this latter group was paralysis of the 3rd cranial nerve; 8 patients showed this sign.

Method

Bilateral carotid arteriography was performed shortly after admission to the hospital. Operation was usually carried out on the day that the arteriogram was performed. The common carotid and proximal portions of the internal and external carotid arteries were surgically exposed with the patient under local anesthesia. Intravascular pressure measurements were made through a 19-gauge needle inserted into the common carotid artery near its bifurcation. After obtaining control measurements, the common carotid was occluded proximal to the recording needle and the reduction in intravascular pressure measured.‡ A Crutchfield clamp was applied to the common carotid artery and the clamp closed to the point at which a slight reduction in the distal intracarotid pressure was effected (approximately 10% reduction). The portion of the clamp (screwdriver assembly) that remains outside the wound was brought out through a separate stab wound. The interval required for clamp closure varied from 1 day to 2

† Prior to 1960, intravascular pressures were recorded using a Sanborn electromanometer. Since this date, the measurements have been obtained with a Statham transducer, Model P23dB. The recordings were made on a Sanborn twin-viso direct writing recorder.

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weeks. In each patient, the screwdriver portion of the clamp was removed 24 hours after the common carotid artery had been completely occluded.

Follow-up carotid arteriography and measurements of intravascular pressure were performed at intervals ranging from 1 day to 48 months after complete closure of the clamp. All patients were hospitalized in order to carry out these studies. Both the arteriogram and intravascular pressure measurement were accomplished by percutaneous puncture of the internal carotid artery above the site of common carotid ligation. Intravascular pressure measurements were made as described above. The per cent reduction in distal intracarotid pressure was computed by comparing it either with simultaneously measured intravascular pressure in the opposite common carotid artery or with brachial artery pressure obtained with a sphygmomanometer.

Retinal artery pressures were measured with a Baillart ophthalmodynamometer both at the time of complete clamp closure and follow-up arteriography. The ophthalmodynamometer is not designed to measure values in excess of 150 gm. of water. In 32 cases, the systolic pressure at one time or another was greater than 150 gm. of water. Thus, comparative studies between the two eyes both at the time of clamp closure and at the time of follow-up study could not be made in these cases.

Effect of Carotid Ligation on the Aneurysm

The data are shown in Table 1 and the changes illustrated in Figs. 1–4.

Group 1. 41 cases. The aneurysm was not visualized in 12 patients (Fig. 1), was significantly smaller in 19 (Fig. 2), was unchanged in 9, and was larger in 1 case.

Group 2. 12 cases. The aneurysm was not visualized in 4 (Fig. 3), was significantly smaller in 4, and was unchanged in 4 cases.

Group 3. 5 cases. Of this group, 1 was not visualized, 3 were significantly smaller (Fig. 4), and 1 showed no change.

Thus, in 58 patients with aneurysms on the internal carotid artery, the aneurysm was not visualized in 17 patients (29.3%), was significantly smaller in 26 (44.8%), was unchanged in size in 14 (24.1%), and was larger in 1 case (1.7%). The mean time interval between complete closure of the clamp and follow-up arteriography was 14.6 months in the group in whom the aneurysm was not visualized, 9.4 months in those patients in whom the aneurysm was significantly smaller, and 10.6 months in those patients in whom the aneurysm was unchanged.

Pressure Measurements

A. Intravascular pressure. The terms “immediate” and “late” intravascular pressures refer to measurements made at the time of application of the Crutchfield clamp and at the time of follow-up carotid arteriography, respectively. Immediate intravascular pressure recordings were made in all 58 cases and late intravascular pressure measurements in

<table>
<thead>
<tr>
<th>Location of Aneurysm</th>
<th>No. of Cases</th>
<th>Interval* (mean) mos.</th>
<th>Status of Aneurysm (No. of Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Visualized</td>
</tr>
<tr>
<td>Group 1. Bifurcation, post-comm.</td>
<td>41</td>
<td>11.74</td>
<td>12</td>
</tr>
<tr>
<td>Group 2. Between post-comm. and cavernous sinus</td>
<td>12</td>
<td>11.88</td>
<td>4</td>
</tr>
<tr>
<td>Group 3. Cavernous sinus, carotid canal</td>
<td>5</td>
<td>16.67</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td></td>
<td>17 (29.3%)</td>
</tr>
</tbody>
</table>

* Interval between complete closure of clamp and follow-up arteriography.