Angiographic Occlusive Patterns of the Internal Carotid Artery*

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The vast literature on angiography pays little attention to the shape of the column of contrast medium at the site of occlusion. If the medium does not flow beyond a certain point it is assumed that the obstruction of the artery itself was visualized. Occlusion of the carotid artery may appear as intracranial, extracranial, complete, and incomplete patterns.

Evidence from the medical literature and from personal experience indicates occasional false localization of arterial occlusion with angiography. A long segment of an artery may not be visualized because of the slow movement of contrast material in a stagnant column of blood proximal to an occlusion.

The significance of false localization from the point of view of endarterectomies and embolectomies is obvious. This is a review of carotid occlusions seen at the University Hospital in Saskatoon in the last 10 years, analyzing and classifying occlusive patterns and pointing out false localizing signs.

Method

Table 1 shows the manner in which 164 cases were diagnosed as occlusion of the carotid artery. Sixty-eight cases were excluded because of lack of confirmation by angiogram, postmortem examination, or surgery. Ninety-six cases were studied with special reference to angiographic occlusive patterns. Operative reports and postmortem examinations were reviewed and correlated with the angiograms, particularly in regard to the site and nature of the occlusion.

Results

Complete extracranial occlusion as determined by angiogram occurred 17 times more often than intracranial occlusions (Table 2). The postmortem demonstrations are also summarized in Table 2.

A false-positive diagnosis of extracranial carotid artery occlusion occurred 10 times; twice the mistake was demonstrated on the operating table and eight times at postmortem examination. These two groups of false-positive occlusive patterns represent two distinct clinical groups:

Group 1. These were typical cases of acute cerebrovascular accidents. The angiograms showed a typical snubbed-off appearance of the internal carotid artery above the bifurcation (Fig. 1), but the operative findings did not confirm this diagnosis. Because of lack of backflow from the distal segment, intracranial occlusion of the carotid artery was suspected or diagnosed on the operating table.

Group 2. The patients in this group were suffering from increased intracranial pressure, most of them in respiratory arrest, due to spontaneous subarachnoid or intracerebral hemorrhage or a very severe acute head injury. The angiographic pattern showed “spasm” with complete block of the internal carotid artery around the second cervical
### TABLE 2

<table>
<thead>
<tr>
<th>Occlusion</th>
<th>Site at Angiography</th>
<th>Site at Autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extracranial</td>
<td>Intra-cranial</td>
</tr>
<tr>
<td>Complete</td>
<td>34</td>
<td>2</td>
</tr>
<tr>
<td>Incomplete</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td>None (false positive)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

vertebra (Fig. 2). The postmortem examination showed no abnormality of the carotid artery.

### Angiographic Occlusive Patterns

**Occlusive Pattern 1.** This pattern was characterized by complete or incomplete occlusion within a short distance from the carotid bifurcation (Fig. 3). There were 29 cases with typical arteriosclerotic plaques, 16 with a rounded contrast column, and 2 with a pointed column.

**Occlusive Pattern 2.** This pattern was characterized by a long segment between the cervical and intracranial bifurcation, excluded from the circulation and not visualized by the contrast material (4 cases). In a variation of this pattern there was a long tapering segment of the occluded artery which looked "spastic" (11 cases).

**Occlusive Pattern 3.** This pattern was characterized by complete or incomplete intracranial occlusion or "spasm" of the internal carotid artery.

### Postmortem Occlusive Patterns

There were 22 cases examined after death. The occlusive pattern was established from the pathologist's description. There were two cases in which a definite pattern could not be established. In seven the occlusion occurred intracranially, in three it was above the carotid bifurcation, and in three there was occlusion from the carotid bifurcation to the intracranial portion of the internal carotid artery. The three occlusive patterns are shown on Fig. 4.

In eight cases there was no occlusion of the vertebral artery (Fig. 2).

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**Fig. 1.** Left carotid angiogram of a 42-year-old man who suffered head injury with skull fracture on April 23, 1966. Right hemiplegia developed 4 days later. Surgical exploration revealed no occlusion of the internal carotid artery in the neck. Angiogram shows complete occlusion of the internal carotid artery at the cervical bifurcation. Note the pointed contrast column at the point of occlusion.

**Fig. 2.** Angiogram of a 63-year-old woman with increased intracranial pressure due to ruptured aneurysm with subarachnoid and intraventricular hemorrhage. Decerebrate rigidity had occurred before and respiratory arrest at the time of angiography. Postmortem examination showed no evidence of carotid occlusion. Note the long tapering contrast column in the internal carotid artery.