CEREBRAL ANGIOGRAPHY IN CHILDREN
AN ANATOMOCLINICAL EVALUATION

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DURING the last few years numerous papers pertaining to cerebral angiography have been written. Most of the authors included cases of angiography in children, but usually the number has been small and a proper evaluation of how children tolerate the procedure as well as its usefulness in this age group has not been presented. We have thought it worthwhile to analyze a series of 50 cases of different conditions in children verified by necropsy or operation, in which cerebral angiography has been carried out as an adjunct to neurologic diagnosis.

TECHNIQUE

In the great majority of the cases in this series angiography was performed by direct exposure and injection of the common carotid artery in the neck (open technique). In only 7 cases was puncture of the vessel made directly through the skin (percutaneous technique). A short transverse incision, 2 or 3 cm. long, at the level of the cricoid cartilage, is enough to expose the vessel after a brief dissection with scissors. Barbiturates and local infiltration with novocain provide a good anesthesia in patients within the first 2 years of life, but general anesthesia, using ethyl chloride and open drop ether, had to be given in most of the remaining cases to secure adequate immobilization during the radiographic exposures. Infants have a short neck making the procedure more difficult, but in the later ages children with long and skinny necks are most suitable for the percutaneous technique if cooperation can be secured.

COMPLICATIONS

The following complications were encountered:

- Convulsions: 3 cases
- Pneumomediastinum: 2 cases
- Bernard-Horner syndrome: 3 cases

Convulsions appeared during the test in 3 cases. All 3 patients had had convulsions for some time before angiography was performed. One was suffering from encephalitis, 1 from focal epilepsy and 1 from subarachnoid hemorrhage. Two of them were injected with a 75 per cent solution of the contrast medium, the use of which was subsequently discontinued, being replaced by a 35 per cent solution. The convulsions were Jacksonian or tonic and generalized, disappearing spontaneously in a few minutes following the injection.
There were 3 patients who showed a cervical sympathetic paralysis which disappeared within a period of 8 weeks. All these patients were operated upon by the open technique and probably the sympathetic chain was damaged during the dissection of the carotid artery in the neck. In 2 cases there was moderate polypnea with subcutaneous crepitation in the neck during 24 to 48 hours following the procedure. Roentgenograms of the chest revealed a pneumomediastinum that cleared up spontaneously without consequence. Following the injection some patients complained of soreness of the neck for 24 to 48 hours and were relieved by ice bags.

Usually the injection was done on the side where the lesion was suspected, but bilateral and multiple injections (as many as five), using 50 cc. of 35 per cent solution, have been repeated without any apparent disturbance. We have used as contrast media Diodrast (Winthrop), Neo Iopax (Shering) and Pyelectan (Glaxo), with little difference in results and complications, as long as the solution was not higher than 35 per cent concentration. We did not see such complications as thrombosis, embolus, recurrent laryngeal palsy, hematoma and sensitivity reactions, described by previous authors in cases of adults, all the complications herein studied being benign and reversible.

ANATOMOCLINICAL STUDY

Angiography was performed 66 times in a series of 50 children ranging from 9 days to 15 years in age. These patients were affected by various neurological conditions in which it was thought that an angiographic study might be of some help in the diagnosis. In 23 cases the vascular pattern was found to be abnormal, providing important information about the character of the disease in most instances (Table 1).

**TABLE 1**

<table>
<thead>
<tr>
<th>Final Diagnosis</th>
<th>No. of Cases</th>
<th>Pathologic Angiograms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain tumor</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Hydrocephalus not due to brain tumor</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Cerebral malformations</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Acrocephalosyndactylism</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Vascular disease</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Others*</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>50</td>
<td>23</td>
</tr>
</tbody>
</table>

* Including encephalitis, diffuse and focal atrophy, subarachnoid hemorrhage, toxoplasmosis (?), meningovascular lues, and orbital tumor (3 cases).

BRAIN TUMORS

Of the 12 cases of brain tumor studied, 4 failed to show any pathologic change of the cerebral vessels: 2 brain-stem gliomas, 1 craniopharyngioma,