HYPAQUE IN CEREBRAL ANGIOGRAPHY

REPORT OF COMPLICATIONS IN 617 ANGIOGRAMS

SAMUEL J. BRENDLER, M.D.,* AND GEORGE J. HAYES, M.D.†

Neurosurgical Service, Walter Reed Army Hospital, Washington, D.C.

(Received for publication March 13, 1958)

SUCCESS in the radiographic demonstration of the cerebral blood vessels requires not only good visualization, but a technique that is safe for the patient. One of the factors affecting this safety is the radiopaque material itself. Diodrast (iodopyracet) 35 per cent and Urokon (sodium acetrizoate) 30 per cent have been used extensively for cerebral angiography. Within recent years, another radiopaque material, Hypaque (sodium diatrizoate) 50 per cent, has become available, and it is the purpose of this paper to present our recent experience in man regarding the adverse effects of cerebral angiography using this newer material.

CLINICAL MATERIAL

This study is based on 617 intracranial angiograms in 420 patients. The angiograms reported here were performed at Walter Reed Army Hospital from January 1, 1956 through December 10, 1957. The term "intracranial angiogram," as used in this paper, is defined as a single session in which the patient undergoes one or more injections of a radiopaque substance into one carotid artery (common or internal) or into one vertebral artery. In short, the term can be defined as a single "patient-artery-session."

Of the 617 angiograms, 561 were carotid and 56 were vertebral. There were 500 patient-sessions,‡ at 112 of which 2 angiograms were done; at one session, 3 angiograms were done. The patients ranged in age from 18 months to 53 years.

TECHNIQUE OF ANGIOGRAPHY

In the vast majority of patients, the procedure was done under local infiltration anesthesia, using 1 per cent procaine hydrochloride, or 1 per cent lidocaine hydrochloride. General anesthesia (N₂O-O₂-ether) was used on 34 occasions. No sensitivity testing was done, since it has been shown that the complications seen on intracarotid and intravertebral injections of these radiopaque substances are unrelated to the skin tests (Segelov; Curtis). After preparation of the skin with thimerosol, and after infiltration with the local anesthetic, a 3½" 17-gauge needle is inserted into the artery through a 2-mm. skin stab wound; in the case of a carotid artery, the

* Present address: New England Center Hospital, Boston 11, Massachusetts.
† Neurosurgical Service, Walter Reed Army Hospital, Washington, D.C.
‡ Patient-sessions include those instances in which the patient had more than one angiogram at a single session.
HYPAQUE IN CEREBRAL ANGIOGRAPHY

needle is advanced upward one or more centimeters above the site of puncture so as to be more firmly positioned within the lumen of the vessel. Therefore the tip of the needle often lies in the internal carotid artery. The needle is connected to an assembly of syringe, stopcock, and clear plastic tube filled with bubble-free 50 per cent Hypaque. About 8 cc. of the radiopaque material is used for each injection; no irrigation with Hypaque or other solutions is carried out between injections. At the conclusion of the angiogram, the needle is removed and firm pressure is maintained over the site of the puncture for 5 minutes.

The procedure as described above was carried out by 8 neurosurgeons who performed the 617 angiograms in this study. The following factors were recorded for each angiogram:

1. Volume of each injection: 2 cc. to 10 cc. of 50 per cent Hypaque, with an average of 8 cc.
2. Total volume per angiogram: 5 cc. to 120 cc., with an average of 33 cc.
3. Volume per patient-session: 5 cc. to 120 cc., with an average of 38 cc.
4. Injection interval: 1 to 45 minutes, with an average of 6.5 minutes. *
5. Duration of patient-sessions: 30 minutes to 2 hours.

RESULTS

For the purpose of the present paper, complications were represented by new abnormal neurologic signs or symptoms, or by aggravation of previously existing abnormal neurologic signs or symptoms. In this study, complications were considered to be a result of angiography if they occurred (1) during angiography; (2) within 48 hours after angiography, or prior to major intracranial surgery, whichever came first.

Table 1 shows the complications and their pertinent data. There were no deaths, and no permanent neurological sequelae. All complications were transient; there were 2 instances of hemiparesis, and there were 16 instances of seizures, the transient sensory symptoms being considered epileptic manifestations. The patient with headache (Case 5) is reported because it was severe and definitely more than the burning pain usually associated with intracarotid injection of Diodrast or Hypaque.

DISCUSSION

There is ample evidence in the literature concerning the injurious effects on brain of intracarotid injections of various radiopaque materials. Broman and Olsson,5,6 and later Bassett et al.,7 in their studies of intracarotid injection of Diodrast-type contrast media in rabbits, found that the fundamental disturbance was one of increased vascular permeability. In addition, Broman and Olsson noted cerebral vasomotor changes, plus diapedesis, edema, and occasional thrombosis. Also observed were "cramps," respiratory paralysis and lowered blood pressure, which may have been ascribable in part to their use of very large doses per unit weight. Broman and Olsson, and Bas-

* An average interval of 1 to 4 minutes was used in only 28 angiograms, the remainder using 5 minutes or longer.