THE EFFECT OF CONTRAST MEDIA ON THE BLOOD-BRAIN-BARRIER*

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The widespread popularity of the technique of cerebral angiography as a method for more precise diagnosis in selected cases has pointed up the fact that this method is not without morbid and even fatal sequelae. These occur even though errors of judgment in selecting patients and errors of technique and ineptitude in its employment are excluded.

It has been our experience and that of others that these complications cover a wide range of possibilities from petechial hemorrhages of the periorbit and retina to loss of consciousness and death, including between these two extremes, severe burning paresthesias of the contralateral extremities, fine generalized muscular twitchings, convulsions, coma, and irregularity of cardiac and respiratory rate and rhythm.

The incidence of such pathophysiologic complications occurs with great enough frequency to warrant search for cause, and development of methods for prevention. Diodrast, although rapidly excreted and physiologically acceptable, cannot satisfactorily be administered without analgesia because of discomfort induced. Colloidal thorium dioxide on the other hand, while innocuous in the above sense and therefore easily administered under local anesthesia and sometimes productive of greater contrast on films, is stigmatized by its radio-activity and the fact that

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it is retained by the reticulo-endothelial system (Fig. 1).

We therefore attempted the search for a practical solution to the problem, with materials now available, in the laboratory. All possible factors alleged to contribute to unwarranted side effects were analyzed.

METHODS AND MATERIALS

The basic method employed was that used by Broman and Olssen\(^1\)\(^-\)\(^5\) in their earlier analysis of the problem. Using an acid aniline dye which is

![Electrophoretic analysis](image1)

**Fig. 2.** Electrophoretic analysis. All run in phosphate buffer, 0.02 N. PO\(_4\), 0.10 N. NaCl, pH 7.8

\[ \text{X} = 0.0068 \text{ mhos. Current 15 ma, and 120 volts.} \]

I and II are normal patterns for dog serum. III and IV are those obtained from serum of a dog given 50 mg./kg. of Evans blue. The plasma protein peaks are virtually obscured in these tracings by the presence of the opaque dye. V illustrates that the dye alone migrates at about 4 times the speed of the combined dye-serum.

taken up by plasma protein these authors demonstrated breakdown of the blood-brain-barrier (BBB). Dye takeup by the protein molecule is shown by electrophoretic analysis of plasma before and after injection of the dye (Fig. 2). The technique was modified by having the dye in circulation before injection rather than following injection of the contrast medium. Changes