EXPERIMENTAL OCCLUSION OF DURAL SINUSES*

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Experience of one of the authors (A.M.M.) in the surgical treatment of wounds of the dural sinuses during the recent Korean conflict, increasing interest in the circulatory anatomy of the brain, and a paucity of specific experimental information led to this study. Efforts were directed toward accumulation of experimental data with regard to questions arising from sudden disruption of the major superficial venous system as encountered in penetrating cranioencebral trauma and also in the presence of space-occupying intracranial lesions.

TECHNICAL DATA

Twenty-eight Macacus rhesus monkeys, weighing from 6 to 10 lbs., were used. The dural sinus circulation was exposed by employment of biparietal or bifrontoparietal craniectomy. Intravenous pentobarbital (30 mg./kg.) was used as anaesthetic agent. Surgical alteration of the superficial venous outflow was accomplished by ligation, and by intraluminal insertion of skeletal muscle or paraffin.

Cerebral venous circulation was demonstrated before (Fig. 1), during, and after the experiments by direct sinography with 3–5 cc. of 35 per cent and of 75 per cent Diodrast. Inasmuch as direct sinography did not suffice in every instance to demonstrate collateral circulation, additional bilateral carotid arteriography was carried out in 5 animals.†

Unipolar and bipolar electroencephalographic recordings were made in the parietal regions of 5 animals before, during, and after sinus occlusion, using an Offner 4-channel electroencephalograph. Simultaneous cerebrospinal fluid pressure readings were obtained through a #18 spinal needle inserted in the cisterna magna and connected to a water manometer.

Gross and microscopic examinations of specimens of brain and dural sinus were obtained from 16 animals, sacrificed from 3 days to 6 months after completion of the experiment. All types of occlusion were represented.

Microscopic studies of dural sinuses containing intraluminal skeletal muscle were made.

EXPERIMENTAL DATA

I. Occlusion of Rolandic and Bridging Veins (8 monkeys). Bilateral occlusion of the Rolandic veins was produced in 3 animals. This resulted im-

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Fig. 1. Monkey 345. Sinogram without alteration of venous system.

mediately in intense but transitory bilateral cortical swelling. Simultan-
eously marked distention of the superficial venous channels took place. A
neurological deficit did not develop.

In 3 animals all venous tributaries of the superior longitudinal sinus were
interrupted bilaterally. Again transitory, intense, bilateral cortical swelling
and distention of the superficial cortical veins took place. The animals
survived without development of a demonstrable neurological deficit.

In 2 animals unilateral interruption of the venous tributaries to the su-
perior longitudinal sinus was produced. This resulted in homolateral edema
and in homolateral distention of cortical veins. These animals also survived
without development of a demonstrable neurological deficit.

Attempts at demonstrating the collateral network by means of sinog-
raphy failed in all 8 animals. For that reason bilateral carotid arteriography
was performed in 5 of the 8 monkeys in an effort to visualize in the venous
phase the collateral network produced by occlusion of all venous tributaries
to the superior longitudinal sinus. This was successful in 1 animal only
(Fig. 2). The animal, however, expired immediately following the injection
of the dye, which might account for the radiographic success. Postmortem
examination of the brain of all 8 animals failed to reveal any significant
gross or histological pathology.

II. Occlusion of Superior Longitudinal Sinus Anterior to Rolandic Veins
(3 monkeys). Occlusion of the superior longitudinal sinus anterior to the
Rolandic veins was produced in 3 animals by ligation with 0000 silk. Oc-
closure of the sinus at site of ligation was demonstrated in each instance by
sinography.