Emulsified Contrast Ventriculography in Hydrocephalus

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The shunting procedures currently used in the treatment of hydrocephalus have many technical and physiological shortcomings. It is apparent that any form of direct intracranial attack on the cause of hydrocephalus, carried out with a reasonable possibility of cure, is preferable to any known shunting procedure. Pneumoventriculography and positive-contrast ventriculography constitute the most valuable diagnostic procedures available to identify the type of hydrocephalus and to determine whether it is suitable for direct surgical treatment.

We are reporting our experience with 40 cases in which ventriculography by the "emulsion" technique, as described by Portera-Sanchez, et al., was used.

Method

The patient is prepared and premedicated for ventriculography in the usual manner and placed in the supine position. Through the angle of the open fontanelle or a burr hole, a spinal needle or a ventricular cannula is introduced into the ventricular system; with a 20 cc syringe, 12 to 15 cc of cerebrospinal fluid are removed. The needle is left in place while 1 to 2 cc of previously warmed Lipiodol or Pantopaque and 5 cc of air are introduced into the syringe; vigorous shaking by hand for 3 to 5 minutes will produce a homogeneous and milky emulsion of contrast material with cerebrospinal fluid. The patient’s head is positioned so that the face forms a 45° angle with the horizontal plane, with the side where the needle is inserted remaining in the highest position; this will help the emulsion to diffuse more easily through the ventricular system. The emulsion in introduced quickly at a steady rate of flow that will produce a turbulence and good mixture of the emulsion throughout the ventricular system. Generally, a brow-up lateral film with some degree of semiflexion of the head and an anteroposterior view will show most of the details of the ventricular system.

Results

Successful visualization of the ventricular system and communicating pathways was achieved in all 40 unselected hydrocephalic patients (Fig. 1). Of these, 28 were under 3 years of age, the youngest being a few hours old, nine were between 3 and 7 years old, and three were young adults. Congenital aqueductal stenosis without clinical evidence of obvious infection or hemorrhage was found in 11 cases. Meningitis had preceded the development of hydrocephalus in 14 cases, two of which were tuberculous and one due to cysticercosis. The hydrocephalus preceded by meningitis was freely communicating in only five patients; in the other nine it was noncommunicating, seven of them showing severe aqueductal stenosis (Fig. 2). The two cases of tuberculous meningitis revealed sealing and deformity of the fourth ventricle.

Arnold-Chiari malformation associated with myelomeningoceles was found in six patients. Nine patients had intracranial tumors; of these, four were medulloblastomas; the other five included a pontine glioma, craniopharyngioma, meningeval sarcoma, cerebellar angioblastoma, and cerebellar metastatic carcinoma. All tumor cases showed varying degrees of deformity and displacement of the fourth and third ventricles and of the aqueduct (Fig. 3).

There were 12 myelomeningoceles, nine lumbar and three occipital; seven of these were associated with congenital aqueductal stenosis. Three cases showed cranialacuniae and two the Klippel-Feil syndrome.

In all 40 cases, contrast ventriculography was the main diagnostic tool that helped us to detect and locate the cause of the hydrocephalus. Regardless of age and basic pathological process, all patients tolerated the procedure well, the only morbidity being a
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![Image]

**Fig. 1. Ventriculogram showing freely communicating hydrocephalus secondary to cysticercosis in a young adult.**
Note the perfect delineation of the enlarged ventricular system and aqueduct of Sylvius.

Transient rise in temperature of less than 48 hours' duration in five patients. No other complications were observed. Headache, vomiting, or other signs of intracranial hypertension were apparently not induced by this procedure, nor did it interfere with the proper functioning of a subsequent shunting procedure when this became necessary. The 20 patients in the series who are still alive have been observed for over 6 months without showing any reaction attributable to the contrast material.

![Image]

**Fig. 2. Ventriculogram showing post-meningitis hydrocephalus in 3-month-old infant.** Note the highly dilated ventricular system and obstruction at the upper third of the aqueduct of Sylvius.