POSITIVE CONTRAST VENTRICULOGRAPHY—A CRITICAL EVALUATION

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(Received for publication March 15, 1956)

For over a third of a century, ventriculography has occupied a well-deserved position of importance as a diagnostic tool in the localization of intracranial space-occupying and obstructive lesions. Its success depends upon an adequate demonstration of the ventricular system with a contrast medium, usually negative, instilled directly, cisternally, or by the lumbar route. Room air, oxygen, or helium have been the gaseous agents of choice. It is the purpose of this paper to explore the past record of positive contrast media with an eye to their potential utilization in the present-day diagnostic armamentarium. This seems particularly desirable because of the scant attention the subject has received in this country, despite widespread publications in Europe and Latin America.

HISTORICAL BACKGROUND

The history of positive contrast ventriculography has centered around the search for a suitable substance. Davidoff has emphasized that such a compound must fulfill three criteria, namely: (i) It must provide superior contrast in roentgenography. (ii) It must be innocuous to the patient at the time of injection. (iii) It must be free of long-term deleterious effect.

Lipiodol, an iodized poppy-seed oil, was the first compound employed. In 1923 Sicard and co-workers reported instilling it into the ventricles and watching it descend into the lumbar sac without ill effect. However, it was not until 1928 that adequate ventriculograms were reported by Balado. Two years later, he communicated his additional experience using Lipiodol in 90 cases in efforts to demonstrate the 3rd ventricle, aqueduct and 4th ventricle. He found it superior to negative media and felt that Lipiodol was harmless. In 1935, Lysholm discussed his results using Lipiodol in 114 cases over a 2-year period. He noted that reliance on positive media had diminished as techniques of air studies improved. In addition, he considered Lipiodol undesirable because of very definite irritating properties, especially on the ependyma, if the material were allowed to remain in the ventricles. Furthermore, its high viscosity occasionally worsened the condition of patients with obstructive lesions of the aqueduct, necessitating repeated ventricular taps to relieve the intraventricular pressure. Marcovich et al. have reviewed the action of Lipiodol on the leptomeninges and have confirmed its irritating aftereffects in several autopsies.

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Recognizing the limitations of Lipiodol, efforts were made to find a suitable substitute by Antoni, in 1932, with the introduction of Thorotrast (thorium dioxide). The following year Schoenfeld and Freeman reported favorably on their experiences with Thorotrast. Twining and Rowbotham were also optimistic about its possibilities. In 1936, Freeman et al. summarized 20 cases in which Thorotrast was used. Despite one death, not necessarily attributable to the Thorotrast, the writers recommended the procedure. However, objections to thorium dioxide were subsequently raised on two counts. Because of its deposition in the cells of the reticuloendothelial system, excretion is limited. Concentrations of this radioactive material were suspected as carcinogenic agents. The ependyma and leptomeninges were also adversely affected. Alexander et al. confirmed its role in producing ependymitis. In 1938 Reeves and Stuck likewise demonstrated the severe histologic reaction of the leptomeninges. Unfortunately, the last has not been heard concerning the long-term deleterious effects of Thorotrast. As recently as 1933, Hughes reported a case of aseptic spinal meningitis 13 years after ventriculography. He strongly implicated the Thorotrast employed.

In 1942, clinical trials were conducted using a new contrast medium, Pantopaque (ethyl iodo phenyl undecylate). It was designed to replace Lipiodol in myelography. According to Steinhausen et al. its main advantages lay in its lower viscosity and minimal irritative qualities. Peacher and Robertson confirmed this in a large series of cases. In 1946, Bull began using Pantopaque in ventriculography. Over a 5-year period he employed the substance in 80 cases without ill effect. In spite of widespread utilization of Pantopaque, few reactions were reported. Nevertheless, occasional disturbing cases have been brought to light. Tarlov reported meningeal adhesions in the cauda equina 60 hours after Pantopaque myelography. Mackay has mentioned the occurrence of multiple extra-ocular palsies following cranial extension of Pantopaque from a lumbar myelography. Errors in technique during the instillation of Pantopaque may have accounted for some cases of spinal arachnoiditis. According to Winkelman et al. improper cleansing of detergent from syringes or the production of blood at the time of spinal puncture may be responsible for some of the adverse effects attributed to Pantopaque itself. By far the most damaging report is that of Erickson and van Baaren, which cites the history of a patient who died of adhesive arachnoiditis of the basilar cisterns. Pantopaque, from a myelogram 15 months earlier, was clearly shown to be the etiologic agent. How many additional cases of this kind will appear remains to be seen. It merely points up the uncomfortable truth that, despite its universal acceptance, Pantopaque is not innocuous. Consequently, a search for a safer medium is still desirable.

INDICATIONS FOR POSITIVE CONTRAST VENTRICULOGRAPHY

Positive contrast should never be considered a replacement of or an alternative to the standard approach. Gas ventriculography should always be the initial choice and its possibilities utilized to the fullest. To locate the