Iodoventriculography by Direct Catheterization of Third Ventricle in Posterior Fossa Lesions of Childhood

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Ingram and Matson in their monograph stated that approximately 60 to 70 per cent of all intracranial tumors of childhood occur below the tentorium, and, more commonly, along the central neural axis with resulting internal hydrocephalus. Visualization of the midline ventricular and cisternal systems is rendered difficult because of the dangers inherent in pneumoencephalography, and because of overlying air and bony shadows in pneumoventriculography when utilizing these techniques in cases of subtentorial tumors. Newer methods have been described for direct catheterization of the 3rd ventricle and use of Pantopaque ventriculography. Twelve cases of direct catheterization of the 3rd ventricle in children with demonstration of midline ventricular structures by Pantopaque are presented here. There were no complications or ill effects.

Historical. Balado et al. in 1927 first introduced Lipiodol into the lateral ventricle for visualization of midline ventricular structures. Schoenfeld and Freeman, Twinning and Rowbotham, and Alexander et al. used Thororast as a contrast medium, but this was discontinued because of fear of later reactions. In 1937 Carrillo, a pupil of Balado, reviewed 500 cases using Lipiodol without adverse effects and gave a detailed neurorontgenologic interpretation. Albaranque gave his thesis in 1943 on uses of iodoventriculography in cases of intracranial pressure. In 1957 Amezúa and de Pardal confirmed the safety of the Balado-Carrillo technique with a report of 1,280 iodoventriculograms performed in the Neurosurgical Department of the University of Buenos Aires, Argentina.

Bull and Horwitz described the use of Pantopaque in contrast studies of the 3rd and 4th ventricles. Mone and Werman in 1958 introduced the contrast medium into this same area by injecting the substance into the lumbar space and running it upwards with the patient in the supine position, entitling it rhomboencephalography. Ralston et al. inserted contrast medium through a frontal burr hole into the frontal horn, followed by manipulation and running of the dye into the caudal ventricular system.

Azambuja et al. in 1956 practiced direct catheterization of the 3rd ventricle for visualization of the caudal structures using air injected through a fine catheter inserted through a frontal burr hole. Direct catheterization of the 3rd ventricle with use of Pantopaque has been used by Sedzimir and Iwan in human stereotaxic surgery. The writer has applied this same technique in children with subtentorial lesions.

Operative Technique

Under local anesthesia, with the patient supine and the head elevated and turned slightly to the left, a burr hole is made on the right side of the coronal suture 2 cm from the midline (Fig. 1). A ventricular needle is inserted into the frontal horn and is replaced by a fine, soft rubber or latex catheter which is then inserted through the tract of this needle. After reaching the frontal horn its insertion is continued until it touches the floor of the ventricle, causing it to naturally slide posteriorly and medially following the curvature of the head of the caudate nucleus until it enters the foramen of Monro, stopping at the posterior inferior recess of the 3rd ventricle. Lateral films for localization are taken to determine the position of the tip of the catheter, which should lie between vertical lines drawn from the anterior clinoid process and from the external auditory canal in the lateral view (Figs. 3 and 7), and in the midline area in the frontal view (Figs. 4 and 8). Azambuja et al. stated "the catheter is in proper position when its tip in a lateral film appears between two parallel vertical lines intersecting the anterior clinoid and the auditory meatus and two parallel
Iodoventriculography for Subtentorial Lesions

of the posterior part of the 3rd ventricle, aqueduct and 4th ventricle is obtained. These roentgenograms are taken immediately following injection, thereby demonstrating total block in midline lesions and lateral displacement of the aqueduct and 4th ventricle in lateral cerebellar lesions. When no block occurs, the contrast material can be removed by lumbar puncture. The anterior part of the 3rd ventricle can be visualized by additional injection of 5 or 10 cc. of oxygen.

**Case Illustrations**

This technique has been used at the Children’s Hospital, Cordoba, to demonstrate the caudal ventricular system* in 11 patients with or without lesions, and in 1 additional patient operated upon with Dr. William Beecher Scoville—a child with a cerebellar astrocytoma—during the author’s visit to the Hartford Hospital in October 1962.

**Case 1.** A neuroblastoma of the cerebellar vermis, in which pneumoencephalography and air ventriculography had failed to give adequate localization, caused a convex obstruction in the superior portion of the dilated 4th ventricle by iodoventriculography (Fig. 3).

**Case 2.** A medulloblastoma directly invading the left lateral portion of the 4th ventricle caused a shift of the aqueduct and 4th ventricle (Fig. 4).

* Term used by Ralston et al. to describe the aqueduct and 4th ventricle.

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**Fig. 1.** Artist’s conception of central midline iodoventriculography. Preparation of this drawing by Miss Ruiz is gratefully acknowledged.

horizontal lines running on a level of the sphenoid plane and a parallel line 2 cm. above it” (Figs. 3 and 7).

The catheter is left in place after closing the skin and galea in layers and 2 cc. of Pantopaque or Lipiodol are injected with the head continued in a face-up position, slightly elevated, and turned slightly to the left. One lateral and two frontal roentgen-ray views are taken, including a straight anteroposterior and semi-axial frontal view. Fig. 2 shows normal iodoventriculograms. Visualization

**Fig. 2.** Normal iodoventriculography. In this case filling was accomplished by the lateral ventricular route.
Case 3. An encephalitic process giving signs and symptoms of a lesion of the posterior fossa was diagnosed by a normal aqueduct, and 3rd and 4th ventricles (Fig. 5). There was clinical recovery.

Case 4. A neuroblastoma of the 4th ventricle caused a lateral shift of a dilated aqueduct with a "cut-off" of the 4th ventricle (Fig. 6).

Comment

Exquisite visualization of the aqueduct of Sylvius is possible with selective iodoventriculography of the midline ventricular system. Carrillo in 1937 first described a deviation of the aqueduct. Fig. 3 demonstrates a blocked and dilated aqueduct. Fig. 7 reveals a blocked aqueduct at its point of origin, with concomitant deformity of the adjacent 3rd ventricle. Fig. 8 shows a stretching and deformity of the aqueduct in a vertical direction by a tumor in the middle vermis. Fig. 9 demonstrates lateral displacement of the aqueduct and 4th ventricle, with filling of the cisterna, in laterally placed cerebellar hemispheric tumors. Angle tumors may displace only the aqueduct, leaving an undisplaced and poorly filled 4th ventricle. Bilateral acoustic neurinoma may cause an inverted triangular expansion of the aqueduct.

In conclusion, direct catheterization of the 3rd ventricle with iodoventriculography of the midline ventricular system is offered as an accurate method for the localization of tumors of the posterior fossa.
Conclusions

1) A brief historical presentation has been made of methods utilized in the visualization of the midline ventricular structures.

2) The method of Sedzimir and Iwan is preferred. It consists of direct catheterization of the 3rd ventricle with injection of Lipiodol or Pantopaque contrast medium.

3) This method permits a more precise visualization of the 3rd and 4th ventricles and connecting aqueduct. It offers the advantages of speed, safety and simplicity. No harmful effects have been noted.

4) Twelve cases of its use in children with suspected or confirmed lesions of the posterior fossa are reported, with roentgenograms of the various deformities observed in midline ventricular structures.
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References

Fig. 9. (Left) Iodoventriculography showing vertical displacement and vertical stretching. (Right) There is marked lateral shift of aqueduct and 4th ventricle by lesion of cerebellar hemisphere.