Ventriculofiberscope: a new technique for endoscopic diagnosis and operation

Technical note

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The authors report a new ventriculofiberscope useful in both diagnosing and operating on lesions of the ventricular system. The technique and its advantages are illustrated in representative cases.

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Since the first description of a ventriculoscope by Dandy in 1922, various kinds of ventriculoscopes have been reported by Fay and Grant, Putnam, Guiot, et al., and Scarff. Most of them were used for the endoscopic cauterization of the choroid plexus in the treatment of hydrocephalus. However, these endoscopes have not become popular in neurosurgical fields because of their restricted clinical use; they have been rigid, have provided a restricted view, and have been too large in diameter. The authors have devised a new flexible "ventriculofiberscope" and proved its value through clinical experience.

Description of the Ventriculofiberscope

The ventriculofiberscope (Fig. 1) consists of three parts: a control section, a flexible tube that is inserted into the ventricle, and a light guide tube that conducts the light from a xenon lamp. It has several features that were not previously incorporated in such an instrument. It is smooth, flexible, and small in outer diameter (4 mm); it has a special wide-angle lens (68°) and an image guide of high resolving power that produces vivid images with a powerful light supply; it has a bending section controlled by a foot lever.

* The Ventriculofiberscope is manufactured by the Olympus Optical Company, Tokyo, Japan.

Fig. 1. Photograph of the ventriculofiberscope showing the light guide tube, eyepiece, control section, 1st portion of flexible tube, 2nd portion of flexible tube, wire probe, double connector, flexible section, and distal end of tube.
and it is equipped with a channel in the flexible tube for irrigation, suction, and insertion of wire probes. Of these four advantages, the most important is the beginning section (Fig. 2). The bending angle from 30° (upward) to 130° (downward) enables the operator to observe the ventricles at will in the wide range, including particularly the posterior half of the third ventricle.

**Operative Procedure**

The ventriculofiberscope is sterilized by means of both formalin gas and benzalkonium chloride solution (Detergicide U.S.C.I.). The control section is fixed on the supporting arm and covered by sterile drapes.

**Insertion**

Usually, the patient is operated on in the supine position under general endotracheal anesthesia. A frontal burr hole is made. The dural incision should be as small as possible to prevent damage to the adjacent brain cortex. A small track is made by use of Nelaton’s rubber tube from No. 3 to 8, until the 4 mm tube can pass into the ventricle. The track must point exactly in the direction of the foramen of Monro. The flexible scope is then advanced along the track under manual guidance. If the CSF is turbid, it is replaced by air injected through the tube (Fig. 3).

**“Standard View” of the Ventrices**

While advancing the ventriculofiberscope, the operator must be aware of its position and understand what he is watching. The endoscopic view of the normal ventricle presents a rather uniform pattern according to the position of the scope. We call this the “standard view.” In making an endoscopic diagnosis it is important to establish orientation with this standard view. As the ventriculofiberscope is inserted into the lateral ventricle, the view around the foramen of Monro is first seen (Fig. 4 A). Three structures make the typical Y-shaped configuration: the septal vein on the medial side, the thalamostriate vein on the lateral side, and the choroid plexus on the floor of the lateral ventricle. By angulation of the flexible sec-
FIG. 4 A. The "standard view" around the foramen of Monro (right lateral ventricle), showing the typical Y-shaped configuration formed by the septal vein, the thalamostriate vein, and the choroid plexus.
B. The "standard view" of the anterior half of the third ventricle, showing the interpeduncular cistern and the basilar artery with its perforating branches between the mammillary body and hypophysis. C. The "standard view" of the posterior half of the third ventricle showing the aditus of the aqueduct, posterior commissure, and pineal region. D. Case 12. The cystic tumor with thin specked capsule is blocking the foramen of Monro. This finding suggests that the tumor is a craniopharyngioma. E. Case 16. The brownish yellow solid tumor (craniopharyngioma) is seen over the foramen of Monro, occupying the anterior half of the third ventricle. Biopsy cup is just pushed out. F. Case 16. Perforation of the septum pellucidum with a cauterizing electrode. G. Case 8. The tumor (pinealoma), finely granular and dark red in color, has occupied the entire posterior half of the third ventricle, compressing the adhesio interthalamica. H. Case 14. The small red tumor occupying the pineal region is seen over the adhesio interthalamica. f.m. = foramen of Monro; n. cd = nucleus caudatus; s.p = septum pellucidum; plx = plexus choriodeus; v. sp = vena septi pellucidi; v. thst = vena thalamostriata; c.m = corpus mamillare; a.b. = arteria basilaris; a.thp = arteriae thalamoperforantes; c. ip = cisterna interpeduncularis; th = thalamus; hyp = hypophysis; a. i = adhesio interthalamica; aq = aqueductus; c.p = commissure posterior; r.p. = recessus pinealis; r. sp = recessus suprapinealis; T = tumor; B = biopsy; CE = cauterizing electrode.
Ventriculofiberscope

...it is possible to observe the lateral ventricle from the anterior horn to the trigonum. Thus, upon advancing the ventriculofiberscope through the foramen of Monro into the third ventricle, the standard view of the anterior half of the third ventricle is observed (Fig. 4 A, B). In cases of hydrocephalus, the basilar artery and hypophysis can be seen through the thinned floor. The flexible section is then angled downward, to obtain a view of the posterior half of the third ventricle (Fig. 4 C). The opening of the aqueduct, posterior commissure, pineal recess, and suprapineal recess can be clearly seen. When the scope is bent to the extreme down angle, the roof of the third ventricle is observed and the vein of Galen and the internal cerebral veins.

Clinical Experience with 37 Cases

The authors have used the ventriculofiberscope to study 37 cases (Table 1) prior to craniotomy. Ventriculofiberscopy contributed to the visual diagnosis, and the histological diagnosis was made through the biopsy; it also made possible endoscopic operations such as ventriculostomy, puncture of a cystic tumor, and coagulation of the choroid plexus.

Visual Diagnosis

There were six cases (two adult and four infants) of hydrocephalus in which the CSF was turbid with or without deformed ventricles. Ventriculofiberscopy in four cases showed a fibrous network or multilobular appearance, which led to a diagnosis of hydrocephalus of inflammatory origin. One case was considered a congenital abnormality, and in another a biopsy was diagnosed histologically as cystic astrocytoma. When a tumor was observed information about its size, shape, and extent was obtained. In one case of recurrent ependymoblastoma, the pneumoventriculography showed a curious asymmetry and deformity of the lateral ventricles; ventriculofiberscopy revealed a tumor filling the left lateral ventricle and emerging on the opposite side over the septum pellucidum. In another case of pinealoma, the tumor was seen expanding into the lateral ventricle, and was operated on successfully by a frontal transventricular approach. Often, the color and surface appearance of the tumor gave some information about its nature. Generally, glioblastomas are a dark reddish-purple and show much surface irregularity; astrocytomas and ependymomas are rather similar to normal brain tissue in appearance; pinealomas show much vascularity and their surface is finely granular.

Endoscopic Biopsy

Endoscopic biopsy was performed on 11 cases by means of a newly designed cup-shaped probe (Fig. 4 E). Of these 11 cases, six were successfully diagnosed histologically: a cystic astrocytoma in the lateral ventricle, an ependymoma of the septum pellucidum, an astrocytoma in the anterior third ventricle, and a craniopharyngioma in the third ventricle. In two cases of thalamic tumor, the biopsy specimen showed astrocytoma and ependymoblastoma respectively. Endoscopic biopsy was not performed on pineal tumors because of the danger of bleeding.

Endoscopic Operation

In four cases of cystic tumor (one cystic
astrocytoma, two craniopharyngioma, and one suspected teratoma), puncture and evacuation of the cyst were performed using a cauterizing electrode or an aspirating probe. All cases showed more or less improvement of their signs and symptoms. In the case of a suspected teratoma occupying the entire third ventricle, puncture and evacuation opened the way to the aqueduct. Perforation of the septum pellucidum (Fig. 4 F) was performed in six cases: in one case of a cyst of the septum pellucidum, in two cases of tumors obliterating the foramen of Monro, cases as a preliminary to the ventriculoatrial shunt that followed.

Puncture of the floor of the third ventricle was done in one instance (third ventriculostomy) but was not effective for the relief of the hydrocephalus. Cauterization of the choroid plexuses was performed in two cases: one a craniopharyngioma, the other, posttraumatic normal-pressure hydrocephalus.

References


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