Acute distortion of the anatomy of the third ventricle during third ventriculostomy

Report of four cases

**JASPER VAN AALST, M.D., EMMIE A. M. BEULS, M.D., FERENC A. VAN NIE, M.D., JOHAN S. H. VLES, M.D., PH.D., AND ERWIN M. J. CORNIPS, M.D.**

Departments of Neurosurgery and Pediatric Neurology, University Hospital of Maastricht, The Netherlands

The authors report on four third ventriculostomy procedures in which upward ballooning of the third ventricular floor occurred immediately after perforation of the floor and withdrawal of a Fogarty catheter. The floor herniated into the third ventricle, hindering the endoscopic view.

Preoperative magnetic resonance imaging demonstrated a similar anatomy in all four cases, consisting of hydrocephalus, extreme dilation of the third ventricle, and disappearance of the interpeduncular cistern due to a very thin, membranous floor of the third ventricle, which herniated downward, draping over the basilar artery. The authors suggest that excessive rinsing in combination with this anatomical configuration provoked the phenomenon of upward ballooning of the third ventricular floor, which is described in this report.

**KEY WORDS** • cerebrospinal fluid • hydrocephalus • third ventriculostomy

**Abbreviations used in this paper:** BA = basilar artery; ETV = endoscopic third ventriculostomy; MR = magnetic resonance.

C HRONIC hydrocephalus due to primary aqueductal stenosis is one of the most popular indications for endoscopic third ventriculostomy. A wealth of technical details and complications concerning ETV have been reported, including the site and size of the perforation, how to make the perforation, which precautions to take to avoid bradycardia, vascular or hypothalamic lesions, and the occurrence of subdural collections after ETV. Special attention is required to avoid creating vascular damage when there is almost no discernible interpeduncular cistern due to downward herniation of the third ventricular floor. Although in such cases it often seems difficult to make the fenestration, an adequate opening can generally be achieved. In this report, however, we describe four cases in which we encountered the technical problem of massive upward ballooning of the floor of the third ventricle immediately after the fenestration had been made.

The four patients presented in this report were participants in a series of 106 consecutive patients treated with ETV between January 1992 and June 2001 at the University Hospital of Maastricht.

**Case Reports**

**Case 1: Primary Illustrative Case**

This 38-year-old man, who suffered from known primary aqueductal stenosis, presented with intermittent complaints of gait disturbance, a feeling of pressure within his head, and visual disturbances.

**Examination.** Physical examination revealed no additional neurological sign or symptom. Magnetic resonance imaging (Fig. 1 upper) revealed the characteristic triventricular hydrocephalus with dilation of the proximal portion of the aqueduct. The third ventricular floor massively herniated downward, draping over the basilar artery. Due to the changed anatomical configuration, the interpeduncular cistern was not discernible and a characteristic downward bending of mammillary bodies was apparent.

**Operation.** An ETV was performed using a rigid disposable neuroendoscope (outer diameter 4.1 mm). The third ventricular floor, which was very thin, draped over the BA. Because of this, we perforated the floor slightly to the left side by using a No. 4 French Fogarty catheter. We then enlarged the perforation by inflating the balloon.

Immediately after withdrawing the catheter, the fragile floor ballooned upward (Fig. 1 center), and within seconds it filled most of the third ventricle and completely obscured the fenestration. Not without difficulty, we reexposed the fenestration alongside the bulging membrane and navigated through the opening to inspect the prepontine cistern. No additional membranes were seen.

Heavy turbulence over the fenestration was noted throughout the procedure, indicating that the ETV was functioning.

**Postoperative Course.** After surgery the patient fared well and all symptoms disappeared. Repeated MR imaging (Fig. 1 lower) demonstrated normalization of the ventricular sys-
tem and the third ventricular floor, although cine–MR imaging did not visualize flow through the perforation.

Summary of Cases 2 Through 4

The other three cases demonstrated similar features. In Case 2 we tried to revisualize the fenestration by shrinking the bulging floor with the aid of bipolar forceps, reshaping it to more-or-less normal proportions. The fenestration came into sight and was easily enlarged with a Fogarty balloon. In Case 3 a second large perforation in the bleb’s dome was made, after which adequate flow was observed. In Case 4 prompt cessation of irrigation prevented a more pronounced ballooning of the floor, and allowed us to proceed immediately with the operation by enlarging the opening and inspecting the basal cisterns.

Discussion

We describe four cases in which the floor of the third ventricle displayed a massive upward ballooning after ETV was performed. This upward ballooning always occurred immediately after opening the floor and withdrawing the Fogarty catheter, and completely obscured the fenestration; heavy turbulence was noted in each case. All four cases had some features in common. Regardless of the underlying disease or indication to perform an ETV, in all four cases the third ventricle was very large, and its floor herniated downward ventrally to the pons and covered the BA, resulting in an almost indiscernible interpeduncular cistern. Figure 2 contains drawings illustrating the anatomical changes encountered during surgery.

Whereas continuous irrigation is standard throughout the ETV procedure, it is our impression that excessive rinsing during perforation and withdrawal of the catheter caused abrupt changes in the distribution of cerebrospinal fluid. We assume that this excessive rinsing in combination with the anatomical configuration of the third ventricular floor provoked the phenomenon described in this report.

In cases of chronic hydrocephalus, a very thin, floppy third ventricular floor can be found herniating downward ventrally to the pons with disappearance of the interpeduncular cistern. This downward herniation is caused by a pressure gradient between the third ventricle and the preoptic cistern. When ETV is performed, pressures on both sides of the floor equalize, allowing the floor to return to its normal anatomical position.

In the four cases described, however, the interpeduncular cistern was suddenly overfilled due to too much rinsing. The fluid excess underneath the overstretched third ventricular floor caused the floor to balloon upward suddenly and massively.

To the best of our knowledge, massive upward ballooning of the floor of the third ventricle during ETV has not been reported in the literature. It can be a rather disturbing experience during surgery. The resulting changes in the anatomical configuration of the third ventricle cause problems with orientation and increase the risk of complications.

Although all four procedures were finally successful, we suggest that the surgeon be careful to avoid excessive rinsing during perforation of the third ventricular floor.

Conclusions

Massive upward ballooning of the floor of the third ventricle, which may be caused by excessive rinsing during ETV, constitutes a worrisome experience during surgery, but does not necessarily hinder completion of the procedure.
Acute distortion of anatomy of third ventricle

The authors express their gratitude to Rogier Trompert Medical Art for the illustrations.

References


Acknowledgment

The authors express their gratitude to Rogier Trompert Medical Art for the illustrations.

Address reprint requests to: Jasper van Aalst, M.D., Department of Neurosurgery, University Hospital of Maastricht, P. Debyelaan 25, Postbus 5800, 6202 AZ Maastricht, The Netherlands. email: jaspervanaalst@hotmail.com.

Manuscript received July 24, 2000. Accepted in final form November 13, 2001.