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Fatal subarachnoid hemorrhage after endoscopic third ventriculostomy

Case report

Henry W. S. Schroeder, M.D., Rolf W. Warzok, M.D., Jamal A. Assaf, M.D., and Michael R. Gaab, M.D., Ph.D.

Departments of Neurosurgery and Neuropathology, Ernst Moritz Arndt University, Greifswald, Germany

In recent years, endoscopic third ventriculostomy has become a well-established procedure for the treatment of various forms of noncommunicating hydrocephalus. Endoscopic third ventriculostomy is considered to be an easy and safe procedure. Complications have rarely been reported in the literature. The authors present a case in which the patient suffered a fatal subarachnoid hemorrhage (SAH) after endoscopic third ventriculostomy.

This 63-year-old man presented with confusion and drowsiness and was admitted in to the hospital in poor general condition. Computerized tomography scanning revealed an obstructive hydrocephalus caused by a tumor located in the cerebellopontine angle. An endoscopic third ventriculostomy was performed with the aid of a Fogarty balloon catheter. Some hours postoperatively, the patient became comatose. Computerized tomography scanning revealed a severe perimesencephalic-peripontine SAH and progressive hydrocephalus. Despite emergency external ventricular drainage, the patient died a few hours later.

Although endoscopic third ventriculostomy is considered to be a simple and safe procedure, one should be aware that severe and sometimes fatal complications may occur. To avoid vascular injury, perforation of the floor of the third ventricle should be performed in the midline, halfway between the infundibular recess and the mamillary bodies, just behind the dorsum sellae.

Key Words * endoscopic third ventriculostomy * subarachnoid hemorrhage * basilar artery * noncommunicating hydrocephalus * neuroendoscopy * vascular injury

With the increasing use of endoscopic techniques in neurosurgery, endoscopic third ventriculostomy has become a well-established procedure for the treatment of several forms of noncommunicating hydrocephalus.[1,5,6,8] Third ventriculostomy is considered to be simple, fast, and safe. Complications have rarely been reported in the literature.[2-4,7,9,10] We present a case in which the patient suffered a fatal subarachnoid hemorrhage (SAH) after he underwent an endoscopic third ventriculostomy.

CASE REPORT

This 63-year-old man presented with hearing loss, facial palsy, facial numbness, and balance problems. A few days before admission, he had become progressively confused and drowsy. He was admitted to our department in poor general condition with signs of cardiopulmonary insufficiency. He had suffered from arterial hypertension, bronchial asthma, and chronic obstructive bronchitis for many years.

Examination. At admission, the patient was alert but confused and did not follow commands. Computerized tomography (CT) scanning revealed a tumor in the left cerebellopontine angle that was causing obstructive hydrocephalus. Because of the patient's poor cardiopulmonary condition, microsurgical tumor removal was not indicated.

Operation. We decided to perform an endoscopic third ventriculostomy to treat the hydrocephalus, which seemed to be the reason for the patient's neurological deterioration. We used a universal neuroendoscopic system (Karl Storz and Co., Tuttlingen, Germany), which was developed by the senior author (M.R.G.). Via a right-sided precoronal burr hole, the operating sheath was inserted into the right lateral ventricle. The diagnostic rod lens scope was introduced. Directly viewing the approach on the monitor, the surgeon navigated the endoscope through the foramen of Monro into the third ventricle. The floor of the third ventricle was thin and translucent. It was bluntly perforated in front of the mamillary bodies with the aid of a No. 3 French Fogarty catheter. After inflating the balloon of the catheter, arterial bleeding occurred at the anterior margin of the opening. To stop the bleeding, the balloon was kept inflated. This attempt failed. After deflation of the balloon and vigorous rinsing, the bleeding perforating vessel as well as the basilar tip and left posterior cerebral artery were visible underneath the ventriculostomy (Fig. 1). After some minutes of irrigation, the bleeding ceased. The endoscope was removed and the skin was closed in layers.

Fig. 1. Endoscopic photograph showing the bleeding perforating vessel (P) at the anterior margin of the ventriculostomy and the left posterior cerebral artery (A). Arrowhead indicates the lumen of the perforating vessel.

Postoperative Course and Autopsy. The patient's initial postoperative course was uneventful. He awoke and displayed confusion as he had earlier. Twelve hours later, the patient became comatose with decerebrate rigidity. An emergency CT scan revealed an extensive perimesencephalic-peripontine SAH and progression of the hydrocephalus (Fig. 2 left). An external ventricular drain was inserted immediately. Nevertheless, the patient died 3 hours later. At autopsy, an extensive

perimesencephalic-peripontine SAH, dilated ventricles, arteriosclerotic major basal arteries, and a left-sided vestibular schwannoma were found (Fig. 2 right).

Fig. 2. Left: Emergency axial CT scan demonstrating perimesencephalic-peripontine SAH and progression of the hydrocephalus. Right: Brain specimen revealing severe SAH.

DISCUSSION

To our knowledge, this is the first report published in the neurosurgical literature of a fatal complication after endoscopic third ventriculostomy. Handler and associates[3] presented a case in which the patient suffered cardiac arrest during endoscopic third ventriculostomy. Fortunately, the girl was successfully resuscitated and made a complete recovery. Recently, McLaughlin, et al.,[7] reported on the formation of a traumatic basilar tip aneurysm after an endoscopic third ventriculostomy, which was performed by perforating the floor of the third ventricle with a potassium titanyl phosphate laser and passing the endoscope through the perforation. In that case, the patient presented with a severe SAH caused by aneurysm rupture 1 month after the endoscopic procedure. The aneurysm was clipped, and subsequently, the patient made a good recovery. Grant and McLone[2] reported a case of major bleeding but no deaths in more than 50 endoscopic third ventriculostomies. In the largest published series of 110 endoscopic third ventriculostomies, Jones, et al.,[4] reported two hemipareses, one midbrain injury, two infections, and one subdural hematoma, but no deaths. A fatal hemorrhage from branches of the posterior cerebral artery, which occurred after a secondary percutaneous third ventriculostomy was performed with the aid of fluoroscopic guidance 10 years after an initial procedure, was reported by Sayers and Kosnik.[11] In 1975, Pierre-Kahn and coworkers[10] published the results of a series of 44 ventriculostomies performed with the aid of a leukotome that was controlled using x-ray film studies. Three patients died as a result of ventricular hemorrhage. In one of these cases, the bleeding was caused by a rupture of the leukotome loop.

In our case, the bleeding might have been avoided. The basilar tip was clearly seen through the translucent floor and the third ventricle was wide. After reviewing the video tape of the procedure,

however, it has become obvious that the Fogarty catheter slipped slightly posteriorly when perforating the floor of the third ventricle. That is why the ventriculostomy was performed directly in front of the mamillary bodies, where the basilar tip and perforating vessels were located. We strongly stress that perforation of the floor of the third ventricle should be made halfway between the infundibular recess and the mamillary bodies in the midline. If this is done, the perforation is usually located just behind the dorsum sellae. In this way, diabetes insipidus, oculomotor palsy, and vascular injury are unlikely to occur. In some cases, however, there is only a very limited space between the clivus and the mamillary bodies. In these cases, the ventriculostomy has to be performed immediately in front of the mamillary bodies. Special care must be taken to avoid vascular damage in these circumstances. Close inspection of the patient's sagittal magnetic resonance images is very helpful in recognizing the relationship between the basilar artery and the floor of the third ventricle. If the floor is very tough, it is advisable to perforate it with a bipolar rod rather than with a flexible catheter, which may slip away, as in our case.

Small hemorrhages frequently occur at the margins of the ventriculostomy when the balloon of the Fogarty catheter is inflated; these hemorrhages cease spontaneously with or even without irrigation. However, a larger bleeding vessel, such as a torn perforating vessel, should be coagulated using a bipolar diathermy probe. Such a vessel should be cauterized even if the bleeding stops spontaneously to prevent rebleeding, as occurred in our case.

In our series of 128 endoscopic third ventriculostomies, this case represents the only death related to the procedure itself. Another patient had meningitis that led to fatal septic multiorgan failure. Hence, in our experience we have had a mortality rate of 1.6%. Nevertheless, we consider the endoscopic third ventriculostomy to be the procedure of choice for the treatment of most cases of obstructive hydrocephalus. In spite of reports on "blind" percutaneous third ventriculostomies in which there are no instances of mortality and only minor deficits, we believe that the endoscopic technique is safer because the ventricle and vessels are visualized and because there is the possibility of active hemostasis. Both deaths occurred in our very early experience. Endoscopic third ventriculostomy has a steep learning curve, but has proved to be efficient, simple, and safe to control noncommunicating hydrocephalus in more than 80% of the cases. Shunt dependence should be avoided, and endoscopic techniques should be used whenever possible.

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Address reprint requests to: Henry W. S. Schroeder, M.D., Department of Neurosurgery, Ernst Moritz Arndt University, Sauerbruchstrasse, D-17487 Greifswald, Germany. email: schroedh@rz.uni-greifswald.de.