Transaqueductal aspiration of pontine hemorrhage with the aid of a neuroendoscope

Technical note

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The authors advocate the use of a 1.7-mm fiberscope to evaluate a hypertensive bilateral tegmental pontine hemorrhage that has ruptured, in part, into the fourth ventricle. In applying this new technique, a fiberscope, which contains a guide tube in the working channel, is inserted into the aqueduct. After the endoscope has been removed, a silicone tube is slid along the guide tube. The hematoma is evacuated through the silicone tube and a potassium titanyl phosphate laser is used to achieve hemostasis.

Key Words • pontine hemorrhage • fiberscope • potassium titanyl phosphate laser

Stereotactic cerebral surgery for hypertensive pontine hematoma has been reported; it is the only procedure performed to treat pontine hematoma. Unfortunately, this method has slight disadvantages, such as the difficulty of maintaining hemostasis and the necessity of creating a track through important tissues. With advances in neuroendoscopic techniques, endoscopic evacuation has become a common treatment for hypertensive hematomas in the supratentorial region, as an alternative to stereotactic surgery.1 We report the first use of this procedure for pontine hematomas (Table 1).

Clinical Material and Methods

Patients are placed supine and given a local anesthetic or neuroleptanalgesic agent. Ventricular drainage is achieved by creating a burr hole 3 cm from the midline at the bregma. A fiberscope (diameter 1.7 mm; Richard Wolf Co., Knittlingen, Germany) is inserted into the third ventricle via the foramen of Monro (Fig. 1). In cases of acute hydrocephalus, the cerebrospinal fluid route is first established by performing a third ventriculostomy, and the endoscope is then steered slightly backward to place the aqueduct in the visual field. Generally, the aqueduct is slightly dilated, and various degrees of clotting are observed. If apertures ruptured by severe ventricular hemorrhage are observed as we gradually insert the endoscope, we pass a 1-mm guide tube through the working channel of the endoscope and hold it in the hematoma cavity. If there is a little rupture, we advance the guide tube from the discolored (yellow) region of the pons. The endoscope is removed by pulling the guide tube 5 mm while pulling the endoscope 5 mm until the endoscope comes out of the burr hole without moving the guide tube. A silicone tube (No. 8 French Cilascon; Kaneka Medical Co., Tokyo, Japan) is inserted into the hematoma cavity along with the guide tube. The hematoma is evacuated by repeatedly rinsing it with physiological saline through the silicone tube. Three hours after surgery, 6000 U of urokinase dissolved in 2 to 3 ml physiological saline is injected via a drainage system put in place during the operation. The drain is removed 5 days later. In case bleeding occurs during surgery, a KTP laser is used for hemostasis.

Representative Case

While taking a bath this patient, a 65-year-old man, became stuporous after a sudden episode of vomiting. He was transported to our hospital by ambulance. At admission, his consciousness level was carotic and his eyes deviated leftward. Computerized tomography scans revealed hematoma in the tegmentum of the pons bilaterally, and the hemorrhage partially reached into the fourth ventricle (Fig. 2 upper). Because the patient also had mild hydrocephalus, a fiberscope (diameter 1.7 mm; Wolf, Inc.) was inserted into the third ventricle along the usual route of ventricular drainage via the foramen of Monro. The procedure, described in the previous section, was performed following administration of a local anesthetic approximately 5 hours after onset of symptoms. After the third ventriculostomy had been completed, the aqueduct was placed in the visual field. Because the aqueduct was dilated to approximately 3 mm, an endoscope was inserted into the aqueduct and a silicone tube was held in the hematoma cavity. Approximately 2 ml of hematoma was aspirated from the silicone tube, after which the cavity was rinsed. The tube was fixed and
the operation was completed. Three hours postoperatively, 6000 U of urokinase dissolved in 2 to 3 ml physiological saline was injected via the drainage system placed at surgery. This procedure was performed at his bedside. Postoperatively the patient was alert and his nystagmus disappeared 2 days after. The drain was removed 5 days later. Computerized tomography scans demonstrated complete evacuation of the hematoma (Fig. 2 lower). The patient continued to experience mild diplopia, but he could walk and was discharged from the hospital 1 month after surgery.

Discussion

We remove hematomas mainly via punctures into the fourth ventricle. If a bilateral tegmental type of hematoma were to be treated conservatively, the functional prognosis would not be good, as reported in many studies. In our representative patient, the man’s palsy was rapidly improved by removal of the hematoma. This was probably because the blood was excluded from the pyramidal tract during the early stage. In this region, the removal of 1 or 2 ml of hematoma during the acute stage could have decisive effects on the patient’s prognosis. Repeated hemorrhage often occurs during hematoma removal when it is performed in the acute stage, and hemostasis is still difficult to achieve when stereotactic cerebral surgery is performed under endoscopic guidance, because it is difficult to manipulate the rigid tip of the endoscope. Therefore, stereotactic cerebral surgery is generally performed during the chronic stage. Because hemostasis is possible to achieve using a KTP laser and by manipulation of a fiberscope, our method is very useful for the treatment of hemorrhage in the acute stage. Because acute hematoma forms clots, however, the amount of hematoma that can be removed is limited. Therefore, 1 to 2 ml of hematoma is evacuated, and the remaining hematoma must be removed by administering urokinase through an indwelling drain. In another patient, repeated hemorrhage occurred during surgery, but hemostasis was maintained with the aid of a KTP laser. Edema caused by heat injury, which could occur from laser irradiation, was not detected after surgery and no surgical complications were observed. We reported on the safety of KTP laser irradiation in the central nervous system and believe that radiation can be safely applied to the brainstem when the laser is set at a low output, close contact, and pulse mode. Basically, this surgery is performed using the procedure shown in Fig. 1. It is often difficult to locate intraventricular hematoma because of the poor resolution provided by a thin fiberscope, and repeated rinsing with physiological saline injected from the surgical aperture is required. If localization is still difficult after repeated rinsing, the surgery is initially

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**Table 1**

**Clinical characteristics of four patients who underwent transaqueductal aspiration of pontine hemorrhage**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs), Sex</th>
<th>Consciousness on Admission</th>
<th>CT Type (transverse diameter)</th>
<th>Time of Op After Symptoms</th>
<th>ADL Outcome at 3 Mos*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49, M</td>
<td>somnolent</td>
<td>unilat tegmentum (18 mm)</td>
<td>5 hrs</td>
<td>III</td>
</tr>
<tr>
<td>2</td>
<td>65, M</td>
<td>stuporous</td>
<td>bilat tegmenta (18 mm)</td>
<td>6 hrs</td>
<td>II</td>
</tr>
<tr>
<td>3</td>
<td>55, M</td>
<td>stuporous</td>
<td>bilat tegmenta (16 mm)</td>
<td>6 hrs</td>
<td>II</td>
</tr>
<tr>
<td>4</td>
<td>60, F</td>
<td>semicomatose</td>
<td>massive (3 cm)</td>
<td>10 days</td>
<td>V</td>
</tr>
</tbody>
</table>

* Activities of daily living (ADL): I = social life; II = domestic life; III = bound to wheelchair; IV = alert and bedridden; and V = prolonged coma.
Endoscopic aspiration of pontine hemorrhage

performed using a thick fiberscope and the remaining part of the operation is completed after switching to a thin fiberscope. In such cases, the procedure is more complicated than stereotactic cerebral surgery, but the mean time between diagnosis and completion of surgery is less than 1 hour. Our method has various advantages over conventional stereotactic cerebral surgery, such as reduction in the time required for determination of targets and body positioning, and concurrent treatment can be performed if hydrocephalus is a complication.

References

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