Long-term resolution of acute, obstructive, triventricular hydrocephalus by endoscopic removal of a third ventricular hematoma without third ventriculostomy

Case report and review of the literature

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Although neuroendoscopy has progressively gained a well-established role in the neurosurgical repertoire for the treatment of several diseases, controversy surrounds the endoscopic management of ICH and IVH, because of the instruments currently available and related technical problems. Despite several reports on hemorrhagic complications during endoscopic procedures and on third ventriculostomy in patients with hydrocephalus caused by ICH or IVH, a literature review revealed only three papers in which the authors had analyzed the endoscopic management of spontaneous ICH. In cases of acute, obstructive hydrocephalus caused by IVH, positioning of an EVD usually represents the first emergency treatment, despite the known risks of catheter obstruction or infection. In the few reported cases of endoscopic removal of an intraventricular hematoma, however, this procedure has been associated with a third ventriculostomy. We describe the case of a patient presenting with acute, obstructive, triventricular hydrocephalus caused by extension of a caudate hemorrhage into the third ventricle and resolved by complete endoscopic removal of the hematoma obstructing the aditus to the aqueduct without performing a third ventriculostomy. To our knowledge, this is the first reported case of another possible application for endoscopic techniques.

KEY WORDS • endoscopy • external ventricular drainage • intracerebral hemorrhage • intraventricular hemorrhage • hydrocephalus • third ventriculostomy

A reduction in the duration of hospitalization is a beneficial consequence. The authors assert that third ventriculostomy is not always needed.

Abbreviations used in this paper: CSF = cerebrospinal fluid; CT = computerized tomography; EVD = external ventricular drain; ICH = intracerebral hemorrhage; IVH = intraventricular hemorrhage; MR = magnetic resonance.
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side. A CT scan revealed a left-sided caudate hemorrhage, which had ruptured into the frontal horn, with partial extension into the third ventricle. At that stage no hydrocephalus was present and the third ventricle was of its regular size (Fig. 1). Three days later the patient demonstrated sudden clinical worsening and she rapidly became stuporous. An emergent CT scan demonstrated an acute, triventricular, obstructive hydrocephalus caused by the complete migration of the hematoma previously sited in the left frontal horn into the third ventricle and by the lesion’s obstruction of the aqueduct aditus (Fig. 2).

Endoscopic Procedure. The patient was prepared for an urgent endoscopic procedure. A rigid endoscope (Minop; Aesculap, Tuttingen, Germany) was inserted into the right frontal horn on the side opposite to the hemorrhage, through a burr hole placed well in front of the coronal suture and just behind the hairline to access the posterior portion of the third ventricle. Despite heavily blood stained CSF, the scope was advanced into the third ventricle through an unobstructed foramen of Monro without difficulty. Here, most of the hematoma was situated on the orifice of the aqueduct, closing it completely (Fig. 3). By prolonged irrigation and aspiration, the clot was partially fragmented and removed. Nonetheless, it was also necessary to manipulate microforceps through the working channel to perform piecemeal removal of the clot and eventually to grasp and retrieve the remaining portion from the third ventricle together with the endoscope trocar. At the end of the procedure, the aqueduct aditus as well as the entire third ventricle appeared to be unobstructed (Fig. 4) and CSF flow clearly restored. Thus, a third ventriculostomy was believed to be unnecessary. A ventricular catheter was positioned endoscopically in front of the foramen of Monro to be used as an EVD in emergency situations. The drain never needed to be opened up, and the catheter was removed on the 2nd day (Fig. 5).

Postoperative Course. Significant clinical improvement was demonstrated following the procedure and has been maintained 18 months after surgery, with the right hemiparesis no longer present. Follow-up MR imaging studies with CSF flow–sensitive sequences confirmed the absence of hydrocephalus and demonstrated a morphologically normal and functional aqueduct (Fig. 6 left and right).

Discussion

Caudate hemorrhages, mostly caused by arterial hyper-
In treating the onset of acute hydrocephalus, a

Conversely, blood clots sited within the ventricles

In patients with an ICH extending into the ventricular system, positioning of an EVD represents a frequently used option in treating the onset of acute hydrocephalus, a recognized prognostic factor for poor outcome. Nevertheless, the risk of infection remains high, particularly with prolonged drainage, ranging from 0 to 40% and increasing up to 100% after the 5th day and by the 10th to 11th day of EVD placement, despite the use of prophylactic antibiotics. In the event of IVH, increased risks of ventricular infection and catheter obstruction have been noted.

Despite steady progress in the endoscopic treatment of intraventricular diseases and the rising technical improvements, management of ICHs and IVHs remains difficult. Endoscopic aspiration of intracerebral clots appears to be a lengthy and incomplete process accompanied by poor visualization through the endoscope and awkward recognition of the brain–hemorrhage interface. The use of a transparent plastic sheet has been recently reported to improve visualization. Conversely, blood clots sited within the ventricles and floating in the CSF seem to be more fragile and more easily removable with irritation and aspiration. Authors of three studies have reported successful experiences in the endoscopic evacuation of intraventricular hematomas.

In these same cases, however, a third ventriculostomy was always performed during the same surgical procedure to treat hydrocephalus and to guarantee long-term results.

The patient in the featured case demonstrated sudden clinical worsening with clear signs of raised intracranial pressure caused by the complete migration into the third ventricle of a hematoma previously localized in the left frontal horn. The lesion and the blood already present in the third ventricle blocked the orifice of the aqueduct and caused the acute onset of obstructive, triventricular hydrocephalus. On a CT scan, however, neither the lateral ventricles nor the fourth ventricle appeared to be full of blood and the subarachnoid spaces were not involved by the bleeding. In view of the neuroimaging findings, we believed that the acutely blocked CSF circulation through the ventricular system could be restored and maintained through endoscopic removal of the third ventricular hematoma and reopening of the aqueduct without necessarily performing a third ventriculostomy. The absence of the ventriculostomy, in fact, would force CSF to travel through its physiological pathway—the aqueduct of Sylvius—and so help in maintaining the patency of the pathway and in continuously flushing residual blood cells from the narrowest points of the ventricular system. Furthermore, after removing the hematoma from the third ventricle, restoration of CSF flow through the aqueduct was immediately achieved and visualized, thus making the third ventriculostomy unnecessary. Note that such reasoning allowed us to avoid using an EVD for several days—the time needed for lysis of the clots, restoration of the physiological CSF pathway, and resolution of the hydrocephalus—without the potential risks of infection or blockage of the ventricular catheter, and a consequently longer hospitalization.

This strategy was possible because the hematoma initially sited in the left frontal horn had completely fallen into the third ventricle, according to CT studies obtained 3 days later (Fig. 2), and we believed that there was no risk of another significant migration of blood clots from the lateral ventricles together with consequent recurrent, acute aqueductal obstruction.

We believe that the distribution of blood—that is, the presence and amount of blood within the lateral ventricles, third and fourth ventricles, and subarachnoid spaces—is an important issue to analyze before planning to treat intraventricular hematomas through endoscopic aspiration without a third ventriculostomy. By avoiding the latter procedure, the anatomical integrity of the third ventricular floor can be maintained and the potentially related complications avoided.

In the patient in the present case, endoscopic removal of the third ventricular hematoma was followed by a rapid improvement of symptoms. A control CT scan obtained a few hours later demonstrated complete removal of the hematoma and resolution of the hydrocephalus. This was spontaneously maintained over the following days without the use of the safety EVD. Because we had never previously avoided perforating the third ventricular floor in similar situations, despite a clear restoration of CSF flow observed during surgery, we decided to introduce an EVD for the patient’s safety. This drain was left in place for only 2 days to minimize the known risks as much as possible. A morphologically normal and functional aqueduct (Fig. 6 left and right) is

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**Fig. 5. Upper:** Postoperative CT scan obtained a few hours after treatment, demonstrating complete removal of the third ventricular hematoma and resolution of hydrocephalus. **Lower:** Control CT scan obtained before removal of the EVD, revealing no recurrence of hydrocephalus.
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Conclusions

Although larger patient series are needed to validate our findings and to define the role of endoscopy and the strategy to use in such circumstances, endoscopic removal of a third ventricular hematoma may represent a simple and effective technical option and a better alternative to prolonged drainage of CSF in selected cases of IVH extending into the third ventricle, when ventricles are not completely full of blood and there is no hemorrhagic extension into the subarachnoid spaces. A reduction in the duration of hospitalization is an important beneficial consequence. We assert that a third ventriculostomy is not always needed to treat hydrocephalus and to achieve an excellent long-term outcome. The option of endoscopic removal is particularly important in emergency conditions when a thorough preoperative MR imaging study of the anatomy of the third ventricle is not always possible.

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References


