Aspiration of coagulated hematoma in the third and fourth ventricles via paracele anterior horn puncture

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Abstract

Intraventricular hemorrhage (IVH) is a neurological urgency with a high mortality and unfavorable prognosis. Fast removal of intraventricular blood should be considered as a priority. The current treatments of IVH mainly focus on external ventricular drain and endoscopic aspiration, but neither way can remove the blood in the fourth ventricle easily and relieve the compression of brainstem. Here we report a unique procedure to solve this problem. A 41-year-old male patient who had suffered sudden attack of headache and disturbance of consciousness for 2 h was diagnosed as having high density lesion in the whole ventricular system by computed tomographic (CT) imaging. An emergent bilateral ventriculopuncture and intraventricular hematoma removal under non-line-of-sight was performed immediately; the catheter was extended to the fourth ventricle to maximally remove the hematoma. Postoperative CT scan demonstrated total removal of IVH and no sign of extra brain damage.

Introduction

Intraventricular hemorrhage (IVH) is an emergent situation which immediately threatens patient’s life and requires rapid or even aggressive intervention. It accounts for 3%–10% of all the spontaneous intracranial hemorrhage.1 To date, it is a consensus to remove the hematoma maximally within a shortest time in order to decrease intracranial pressure (ICP) after IVH,2 but due to the fragility of brain stem tissues and superficial vessels of ventricle walls, very few doctors introduce catheters into the third and fourth ventricles to extract hematoma totally under non-line-of-sight. In our case, we managed to slide a flexible catheter without resistance into the fourth ventricle to remove the hematoma maximally to release the compress of brain stem and restore the cerebrospinal fluid (CSF) circulation immediately.

Case report

A 41-year-old male patient was sent to the emergency room because of sudden attack of headache and disturbance of consciousness for 2 h. His physical conditions had deteriorated when he arrived at the hospital. According to his relatives’ description, the patient had a history of cephalomeningitis when he was 13 years old, which almost caused paralysis of his left extremities. A thorough physical examination was conducted at the emergency room, and the result was unfavorable: Glasgow Coma Scale (GCS) score was 3; bilateral pupils dilated to 5 mm with no response to light and head rigidity; low heart rate, high blood pressure and a few moist rales over both sides of lung base were found. Subsequent computed tomographic (CT) scan detected high intensity lesion in all the expanded ventricles, and the brain stem had been compressed (Fig. 1).

Emergency operation was performed to the patient. We carried out bilateral ventriculopuncture of anterior horn of lateral ventricles and inserted one catheter at each side for lavage and aspiration. The left catheter was slid through the foramen Monro and aqueduct without resistance to the third and fourth ventricles completely under non-line-of-sight, and a total volume of about 80 ml hematoma was extracted. The patient received another CT scan 6 h after operation, which showed that the hematoma had been totally removed and the size of third and fourth ventricles returned to normal (Fig. 2). At the end of operation, one catheter was placed in the fourth ventricle and the other one was retained in the lateral ventricle for external ventricular drain (EVD).
No fibrinolytic agents were administered after operation. The GCS score reached 12 (E4V2M6) and the bilateral catheters were removed three days later. No sign of hydrocephalus or brain stem infarction was detected by CT scan 10 days postoperatively and the patient was soon transferred to a rehabilitation hospital for future therapy.

Discussion

IVH is a neurological urgency with high mortality and poor outcomes. The total volume of hematoma and secondary obstructive hydrocephalus, accompanied by brain stem damage are believed to be negative prognostic predictors of outcome. According to previous studies, the mortality of IVH is as high as 60%–90% if the hematoma extends into all the four ventricles. EVD has been widely applied as a rescue surgical procedure, but the catheter can be obstructed by blood clots frequently and the potential infection may lead to severe outcome. Lavage under neuroendoscopy offers direct visualization in the ventricle, but the rigidness of endoscopes may lead to rebleeding or damage of aquaeductus mesencephali and brainstem.

Based on the anatomical structure, the puncture point of anterior horn of lateral ventricles, the foramen of Monro, and aqueductus mesencephali are almost in line, so the catheter can be slid into the third and fourth ventricles through the regular approach of anterior horn of lateral ventricle puncture. In addition, the density of intraventricular hematoma is lower than normal because of the infiltration of CSF, and the ventricle walls are covered by ependyma, which is compact and not easy to be penetrated by the flexible catheter without a guide wire. We managed to successfully slide the catheter into the fourth ventricle and achieved total removal of the hematoma.

We summarized four important factors when performing IVH aspiration under non-line-of-sight.

1. The diameter and hardness of the catheter affect the effect of hematoma removal. The flexible catheter chosen by us is 4 mm in external diameter and 2.5 mm in internal diameter with 6 lateral apertures at terminal and a 20-cm long tick mark.
2. A 5 ml syringe was used for hematoma removal because it is easy to control the negative pressure of aspiration.
3. Normal saline was injected through the contralateral ventricle to prevent ICP from decreasing too much.
4. The catheter should be moved without resistance.

If the IVH is totally removed during the operation, there will be no need for repeated urokinase injection and the time for EVD will be shorter than normal. The selected catheter was more slender and flexible than ventriculoscopes, which made it easier to get through the aqueduct. Furthermore, the ventriculoscope is expensive and a lot of hospitals in less advanced countries cannot afford it. In this way, ventricle catheter aspiration could be considered as a lifesaving method under the situation of all-ventricle bleeding.
In conclusion, total removal of hematoma in all the ventricles under non-line-of-sight is not a coincidence if the puncture point and the direction of the catheter are appropriate. It is convenient and feasible with generalizable value. Due to the small sample size, more clinical cases and further investigations are needed to testify the feasibility and efficacy of this procedure.

Declaration of interest
The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References
1. Darby DG, Donnan GA, Saling MA, et al. Primary intraventricular hemorrhage: clinical and neuropsychological findings in a prospective stroke series. Neurology. 1988;38:68–75.
2. Basaldella L, Marton E, Fiorindi A, et al. External ventricular drainage alone versus endoscopic surgery for severe intraventricular hemorrhage: a comparative retrospective analysis on outcome and shunt dependency. Neururg Focus. 2012;32:E4.
3. Engelhard HH, Andrews CO, Slavin KV, et al. Current management of intraventricular hemorrhage. Surg Neurol. 2003;60:15–21.
4. Tuhrim S, Horowitz DR, Sacher M, et al. Volume of ventricular blood is an important determinant of outcome in supratentorial intracerebral hemorrhage. Crit Care Med. 1999;27:617–621.
5. Jichici D, Frank JI. Thrombolytic therapy in neurointensive care. Crit Care Clin. 1997;13:201–227.
6. Kuyum N, Demir O, Cirak B. Is external ventricular drainage useful in primary intraventricular hemorrhages? Adv Ther. 2005;22:447–452.
7. Shen PH, Matsuoka Y, Kawajiri K, et al. Treatment of intraventricular hemorrhage using urokinase. Neurol Med Chir (Tokyo). 1990;30:329–333.
8. Oka K, Go Y, Yamamoto M, et al. Experience with an ultrasonic aspirator in neuroendoscopy. Minim Invasive Neurosurg. 1999;42:32–34.