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A case of repeated intracerebral hemorrhages secondary to ventriculoperitoneal shunt

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ABSTRACT

Ventriculoperitoneal shunt is a routinely performed treatment in neurosurgical department. Intracerebral hemorrhage, as a complication after shunt catheterization, is really rare but with high mortality. In this study, we reported a case of a 74-year-old man who suffered from repeated intracerebral hemorrhage after ventriculoperitoneal shunt. The first hemorrhage happened 63 h after the 1st surgery, and most hematomas were located in the ipsilateral occipital lobe and intraventricles, along the ventricular catheter. Fresh blood clot casts blocked the external ventricular draining catheter, which was inserted into the right front horn during the 3rd surgery, indicating new intraventricular bleeding happened. A large hematoma in ipsilateral frontal lobe was detected on the 3rd day after the removal of external ventricular draining catheter. Different hemorrhagic locations and time points were encountered on the same case. We discussed the possible causes of repeated hemorrhage for this case, and the pre-operative preparation including risk evaluation in future clinical work.

Introduction

Ventriculoperitoneal shunt (VP shunt), as a consensus surgical treatment for hydrocephalus, is a frequently performed operation in neurosurgical department. Postoperative intracerebral hemorrhage after VP shunt is one of the most severe complications. In 1985, Matsumura and his colleagues reported the first case of delayed intracerebral hemorrhage after VP shunt [1]. The incidence in published reports varies from 0.3% to 4%. Generally, the incidence of this complication is low; however, the consequence is catastrophic including death. The mechanisms underlying this complication after VP shunt are not clearly understood.

Here, we report an unusual case with repeated intracerebral hemorrhages after VP shunt. Literature is reviewed and the possible causes, risk evaluation and managements are discussed.

Case report

A 74-year-old man presented with a 10-month history of dizziness, which was aggravated for 6 months and accompanied by abnormal gait (short-stepped, broad-based gait, slow turning around). A MRI scan demonstrated enlarged lateral and third ventricles, and multiple lacunar infarctions. The patient was diagnosed as having communicating hydrocephalus.

VP shunt (through right occipital horn to abdomen) was performed using a Codman–Hakim antisiphon programmable valve. The cerebrospinal fluid was clear with a pressure of 140 mmH_2O. The valve opening pressure was set at 120 mmH_2O. On the postoperative day 1, the patient showed great improvement in his ambulation (walking faster, more steady and his turning was easier). A head CT scan on the 2nd postoperative day showed appropriate ventricular catheter placement and smaller lateral ventricles without bleeding along the catheter pathway or in ventricles (Fig. 1 A).

On the early morning of the 3rd postoperative day (63 h after the surgery), the patient vomited suddenly and slipped into coma. A CT scan showed intracerebral hemorrhage around the ventricular catheter, including ipsilateral lateral ventricle and third ventricle (Fig. 1B & C). An urgent intracranial hematoma evacuation (the 2nd surgery) was performed. The ventricular catheter was removed; however, the shunt system was left in place. He recovered consciousness after the surgery, and a follow-up CT showed partial hematoma residual in the lateral and third ventricle (Fig. 2 A & B).

However, the patient's consciousness level decreased progressively, accompanied with high blood pressure and intermittent vomiting. CT examinations on the 6th and 9th day after the 2nd surgery revealed aggravated communicating hydrocephalus. The 3rd surgery, an external ventricular drain, was performed. Better consciousness level was achieved immediately after surgery with spontaneous eye opening and following commands. During the following days, we found that the catheter was blocked repeatedly by fresh blood clots, likely caused by the residual intraventricular hematoma as seen in Fig. 2A & B. On day 10 after the 3rd surgery, the situation was complicated by a second hemorrhage. A large hematoma in right frontal lobe was detected by CT

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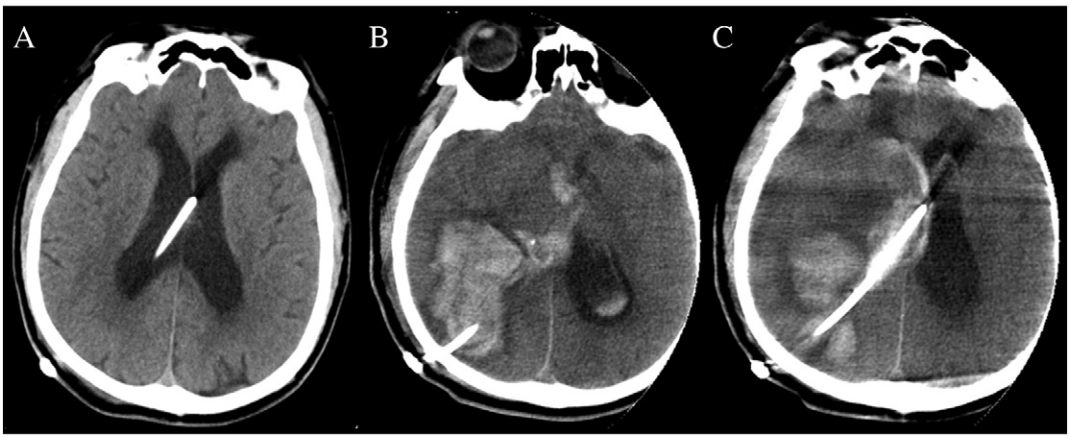

Fig. 1. Post-operative head CT scans on the 2nd day (A), and on the early morning of the 3rd day (B, C) after the ventriculoperitoneal shunt.

scan as shown in Fig. 3 A & B. To save his life, an urgent hematoma evacuation (the 4th surgery) was performed immediately and successfully after thorough discussion with the family about the grim prognosis. However, the wife wished to continue with surgical treatment (Fig. 3C). However, his clinical conditions got worse over the following days. He eventually developed respiratory failure and died one month later after the 4th surgery.

Discussion

Delayed and repeated hemorrhages after VP shunt are rare. The post-operative intracerebral hemorrhage usually occurs soon after the VP shunt. Most hematomas are located along the catheter pathway with or without intraventricular hematoma, but the hematomas of this patient were located in ventricles and different cerebral lobes.

Several possible mechanisms for hemorrhages after VP shunt were described: coagulation disorder (pre-existent bleeding disorder, surgery induced disseminated intravascular coagulation, anticoagulant treatment), mechanical disruption of cerebral blood vessel (direct catheter insertion, indirect erosion of adjacent vessels by the catheter itself), fragile brain tissue or abnormal cerebral vessel (edema, vascular malformation, atherosclerosis, cerebrovascular amyloidosis, moyamoya disease), head trauma, intracranial tumor hemorrhage after shunt. However, the possible mechanisms in this case seem to be oddball. The patient suffered from delayed intracerebral hemorrhages, which were located in ventricles and different cerebral lobes. All the preoperative laboratory tests excluded coagulation defects, and MRA did not find obvious vascular malformations. The first intracerebral hemorrhage happened in less than 72 h after the VP shunt, and was located along the catheter pathway. The mechanism may be the disruption of adjacent vessel by the catheter itself. The second intracerebral hematoma occurred 3 days after the removal of external ventricular draining catheter, which makes complications from catheter insertion or removal less likely; however, it cannot be entirely excluded, because we have not done a CT scan immediately after the placement of the external ventricular drain. We suppose degenerative vasculopathy in elderly people and fragile brain tissue after multiple surgeries might be the reasons for hemorrhage. Besides, the external ventricular drain catheter was blocked by fresh blood clot for several times, which may be the result of vomiting induced high blood pressure and intracranial pressure (ICP).

Unfortunately, we did not find out the exact reasons resulting in the repeated hemorrhages in this case. However, our case alludes to the fact that an overall thorough pre-operative examination to

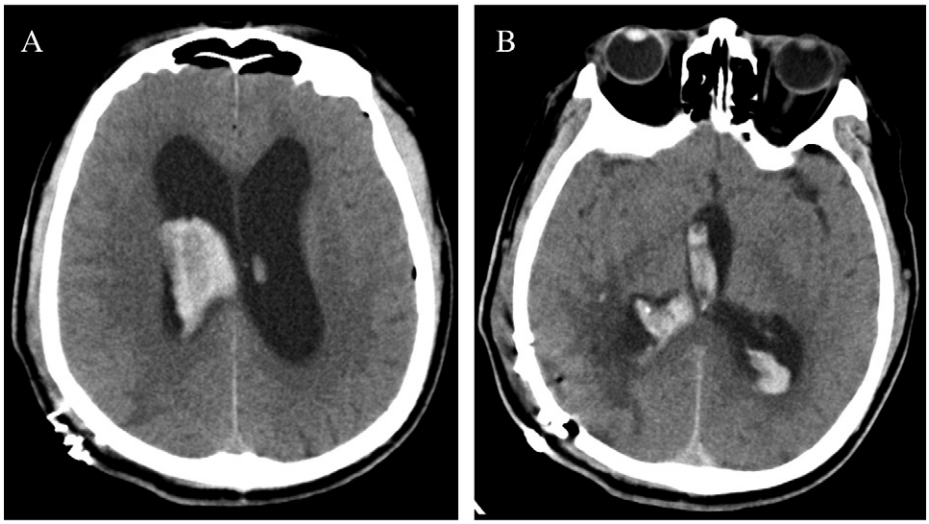

Fig. 2. A follow-up head CT after the second surgery showed partial hematoma residual in the lateral and third ventricle.

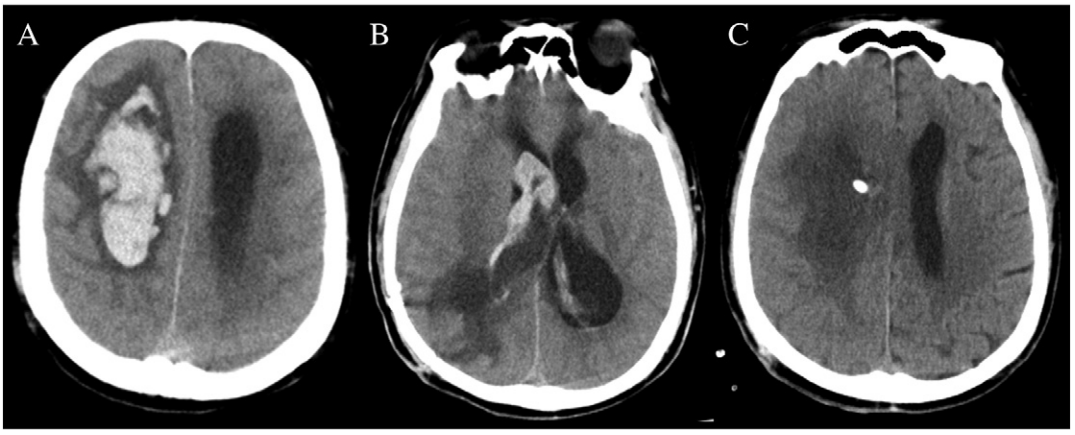

Fig. 3. A large hematoma in right frontal lobe was detected in a head CT scan on the 10th day after the 3rd surgery (external ventricular drain) (A, B). Head CT on the 9th day after the 4th surgery (intracerebral hematoma evacuation) (C).

screen for this rare but disastrous potential complication should be performed for all, but most importantly, for elective VP shunt candidates. For instance, blood examination, transfusion of platelets or appropriate coagulation factors are needed for pre-existent coagulation disorders. Long-acting anti-coagulant therapy should be stopped or replaced by short-acting anti-coagulant drug.

Magnetic resonance imaging (MRI) is another important pre-operative procedure. First, MR angiography (MRA) could exclude marked vascular abnormalities, including moyamoya disease and arteriovenous malformation (AVM). However, Husson and Lasjaunias [2] reported that anomalies of intracranial arteries could be detected by angiography but not by MRA in 34% of their patients, particularly in the branches of middle cerebral artery. Second, T2*-weighted gradient-echo MR imaging could reflect hemosiderin deposits, which were related to prior intracerebral hemorrhages [3]. Presence of such positive T2* signals maybe a risk predictor for intracerebral hemorrhage [4]. Besides, an SWI (Susceptibility Weighting Imaging) is highly recommended for those elder patients, especially suspected amyloid-angiopathy for its hypersensitivity to microbleeding [5].

Patients who developed hydrocephalus after aneurysmal sub-arachnoid hemorrhage are not unusual. CT angiography (CTA) or digital subtraction angiography (DSA) may be needed before VP shunt. The sudden change of intracranial pressure may trigger the rupture of residual or recurrent aneurysms, which should be avoided before the shunt surgery.

Patients with chronic hydrocephalus usually have much thinner cerebral cortex compared with patients with acute hydrocephalus. So, gradual decline of the intracranial pressure may be an appropriate method to minimize the sudden collapse of cortex after VP shunt, which may result in intracranial hemorrhage.

Conclusion

Intracerebral hemorrhage secondary to VP shunt placement is a complication rather than an accident. VP shunt candidates should undergo an overall pre-operative examination, risk evaluation and post-operative management for possible intracerebral hemorrhage, since this is a rare complication but with high mortality.

Author Declaration

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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