

A case of successful intraventricular thrombolysis and external ventricular drain treatment in primary intraventricular hemorrhage

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Summary

Intraventricular hemorrhage (IVH), accounting for about 45% of acute spontaneous intracranial hemorrhage (ICH), is often associated with obstructive hydrocephalus and poor functional outcomes [1] [2]. Obstructive hydrocephalus and increased intracranial pressure are common after IVH because of an obstruction of normal cerebrospinal fluid (CSF) flow and absorption by blood clots. An external ventricular drain (EVD) - a temporary system that permits drainage of cerebral spinal fluid (CSF) from the ventricles to an external closed system) has been indicated for patients with IVH with hydrocephalus and neurologic decline [3]. However, the treatment with EVD alone is often not sufficiently effective due to a likely potential obstruction of the catheter by blood clots. Intraventricular fibrinolysis (IVF) via the extra-ventricular drain has been known to speed clot resolution and maintain the EVD functionality [4]. However, it is also possible that the risk of hemorrhage, infection, and CFS pleocytosis may be increased with IVF therapy, but these have not been demonstrated so far. We report a clinical case of primary IVH with acute obstructive hydrocephalus, successfully treated with a combination of EVD and direct intraventricular injection of rt-PA into the lateral ventricles. This treatment contributes to confirm that combination of EVD and thrombolysis could be considered as a treatment option for selected patients.

Keywords: Intraventricular hemorrhage, intracranial hemorrhage, intraventricular thrombolysis, external ventricular drain, recombinant tissue plasminogen activator (rt-PA).

1. Background

Primary intraventricular hemorrhage (IVH) indicates bleeding confined to the ventricular system surrounded by the brain. However, primary IVH is rare, making up about 3 percent of all spontaneous intracerebral hemorrhage [5]. In approximately 20 to 50 percent of cases (depending

partially on the intensity of the investigation), no cause is identified [6]. The effective treatment for IVH has not been well-established, and its prognosis is typically poor, with mortality rates being 40%-80% [7], [8]. Due to obstructive hydrocephalus, recurrent hemorrhage, or other complications, patients with primary or secondary IVH may develop sudden neurologic deterioration [6]. Acute obstructive hydrocephalus can result when cerebrospinal fluid circulation is obstructed by blood clots which are common in patients with blood in the third or fourth ventricle [6]. This can be catastrophic and frequently requires urgent intervention and an EVD. Catheter

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occlusion caused by clotted blood at the intraventricular orifice and infection are the main complications of EVD. Therefore, the utilization of intraventricular thrombolysis (IVT) can speed clot resolution, avoiding problems with catheter occlusion and shortening the duration of EVD use which may reduce the long-term incidence of communicating hydrocephalus [9]. However, there has been a concern about bleeding complications caused by IVT, with 8 to 20 percent of patients reported suffering from recurrent IVH and/or ICH expansions [10]. In addition, the risk of bacterial meningitis/ventriculitis may be increased with IVT therapy, so that this will be needed to evaluate thoroughly. We present a case of successful intraventricular thrombolysis and EVD treatment in primary IVH with hydrocephalus and neurologic decline.

2. Case presentation

A 67-year-old man was brought by his son to the 103 Military Hospital, a local hospital located in Northern Vietnam. He was admitted to the Emergency Department three hours after a sudden onset of abrupt headache while talking on his mobile phone and developed symptoms, including vomiting and impaired consciousness. The patient was performed mechanical ventilation via endotracheal and transferred to our stroke centre after 6 hours of stroke onset. His son reported that he had a normal medical history and was independent before the stroke. On examination, his vital signs were heart rate of 122bpm, blood pressure of 135/95mmHg, oxygen saturation of 99%, and mechanical ventilation rate of 15/min. His Glasgow Coma Scale (GCS) score was 6 (E1M4V1) with no focal neurologic symptom (both pupils of 1.5mm with response to light). His National Institutes of Health Stroke Scale (NIHSS) score was 30 at admission. An immediate non-contrast head computed tomography (CT) revealed blood within the ventricular system, an enlargement of the lateral 3rd and 4th ventricles

that suggested obstructive hydrocephalus, and a Graeb score of 9 in CT scan (Fig. 1a). The Graeb score is for IVH extension scoring, ranging from 0 to 12 points, with higher scores denoting increased IVH volumes [11]. His CT angiography (CTA) showed no vascular abnormalities (Fig. 1b). Additional tests, including prothrombin time, partial thromboplastin time, and platelet count, showed no abnormal findings. He was immediately taken to the operating room at 8 hours after symptoms onset. An EVD was placed, and the patient received standard investigation and treatment of IVH [12]. The correct intraventricular positioning of the ventriculostomy catheter was confirmed by CT (Fig. 1c). In the postoperative period, the patient's clinical status did not improve, the intracranial pressure (ICP) waveform demonstrated intracranial hypertension, and the amount of CSF collection was judged to be low at 4ml per hour. After 13 hours from symptom onset, the patient was treated with 1mg of rt-PA administered through EVD and then flushed the EVD with 3ml of saline, followed by one hour of drainage closure. After reopening the ventricular drainage, CSF was drained, and the ICP was monitored closely until the next injection every 8 hours. The patient received five injections of rt-PA. After failure weaning, a tracheotomy was performed after 5 days of endotracheal intubation. The patient regained consciousness as the IVH cleared and underwent a good recovery. Follow-up head CTs showed a decrease in ventricular enlargement on the second day after placing EVD. The blood clots in the third and fourth ventricles were completely lysed on day 6, and the EVD was removed on day 9 after initiation of the intraventricular rt-PA treatment (Fig. 1d). The patient was discharged to a rehabilitation facility on day 16 after the stroke. One month after discharge, the patient had mild expressive aphasia and very mild quadriplegic paralysis with a modified Rankin Score of 1.

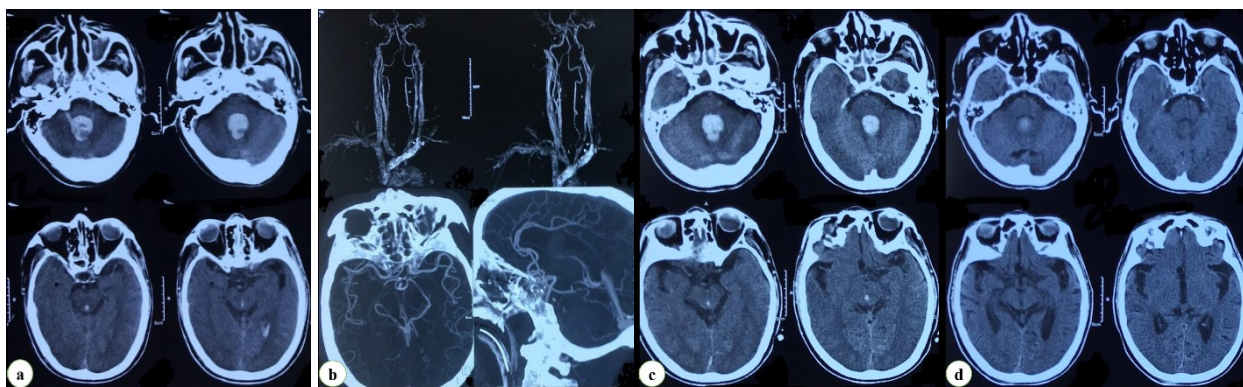


Figure 1. (a) Initial brain CT scan, (b) CTA, (c) follow-up brain CT at day 1, and (d) at day 9 post-hemorrhage.

1. (a) Initial brain CT scan showed that blood within the ventricular system, an enlargement of the lateral 3rd and 4th ventricles that suggested obstructive hydrocephalus, and a Graeb score of 9 in CT scan.

1. (b) CT angiography (CTA) showed no vascular abnormalities

1. (c) Follow-up brain CT at day 1 revealed a decrease in ventricular enlargement

1. (d) Follow-up brain CT at day 9 post-hemorrhage showed blood clots in the third and fourth ventricles were completely lysed.

3. Discussion

IVH occurs in 40-45% of ICH and carries a worse functional outcome [2]. The mortality for IVH is related to the amount of intraventricular blood and increases when the fourth ventricle is involved [13]. A consequence of intraventricular bleeding is an impaired circulation of CSF and results in acute occlusive hydrocephalus and dilatation of the ventricular system. Therefore, placing an EVD is indicated for patients with hydrocephalus and deteriorating neurologic conditions [3]. Our patient was admitted to the hospital after 7 hours of stroke onset with comatose status, the GCS score of 6 (E1M4V1) due to IVH and obstructive hydrocephalus. An EVD was placed immediately after diagnosis of IVH for monitoring and managing ICP, and assisting with clearance of intraventricular blood. However, the ventricular catheter frequently obstructs due to blood clots, leading to ICP elevation and potential brain herniation. Postoperatively, the EVD was obstructed due to clotted blood. Recent animal studies and clinical studies demonstrate that thrombolytic drugs administered intraventricularly through an EVD have evolved in response to catheter obstruction problems and have been shown to be safe and effective and may reduce morbidity and mortality [1], [14]. Additionally, in phase II, the Clot Lysis

Evaluation of Accelerated Resolution of Intraventricular Hemorrhage (CLEAR-IVH) trial emphasized that patients treated with a combination of EVD and rt-PA had lower ICPs, shorter duration of EVD use and fewer ventricular catheter obstructions than those got EVD alone [10]. In phase III of Clot Lysis Evaluation of Accelerated Resolution of Intraventricular Hemorrhage (CLEAR-III), Hanley and colleagues reported that patients with IVH who received IVT via EVD had lower mortality than the placebo group [15].

4. Conclusion

We used the low-dose rt-PA administered through EVD according to the CLEAR-III trial in this patient to dissolve the residual blood clot after IVH. This treatment was used to expedite the clearance of the IVH without further hemorrhage and had a potential benefit to the patient. The patient's successful treatment suggests that intraventricular fibrinolytic rt-PA therapy for moderate to severe IVH may be safe and effective.

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