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Case Report

A Case of Rapid Spontaneous Disappearance of Traumatic Intraventricular Hemorrhage

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Conflict of Interest
The author has no financial conflicts of interest.

ABSTRACT

Although the exact timing depends on the location of the traumatic brain injury (TBI) and the amount of hemorrhage, in the absence of neurosurgical interventions it usually takes several weeks or months for spontaneous resolution of the hemorrhage or hematoma. The occasional rapid disappearance of an intracranial hemorrhage after a TBI has been well-described in the literature. However, early spontaneous disappearance of traumatic intraventricular hemorrhage (TIVH) has not previously been reported in the literature. Herein, the author described a rare case of TIVH that disappeared rapidly without surgical intervention and speculated that the thrombolytic enzyme system in the cerebrospinal fluid (CSF) or circulation of CSF plays an important role in the rapid disappearance of TIVH.

Keywords: Traumatic brain injury; Intracranial hemorrhage; Cerebrospinal fluid

INTRODUCTION

Traumatic brain injury (TBI) can be divided into traumatic intracerebral hemorrhage (TICH), traumatic subdural hematoma (TSDH), traumatic epidural hematoma (TEDH), traumatic subarachnoid hemorrhage (TSAH), and traumatic intraventricular hemorrhage (TIVH), depending on the location of the hemorrhage. These different types of hemorrhage can develop alone or together, depending on the severity of the TBI and the mechanism of injury. Although the exact timing depends on the location of the TBI and the amount of hemorrhage, in the absence of neurosurgical interventions it usually takes several weeks or months for spontaneous resolution of the hemorrhage or hematoma.[2,6] The occasional rapid disappearance of an intracranial hemorrhage after a TBI (i.e., TICH, TSDH, TEDH, and TSAH) has been well-described in the literature. However, early spontaneous disappearance of TIVH has not previously been reported in the literature. Herein, the author described a rare case of TIVH that disappeared rapidly without surgical intervention and discussed the mechanisms of this rare phenomenon.

CASE REPORT

A 38-year-old male patient came to the hospital with head injury caused by a passenger traffic car accident. On admission, she complained only of a mild headache. Physical examination revealed swelling in the right temporal area. His medical and surgical histories and neurological examination were unremarkable. A cranial computed tomography (CT) scan performed 30 minutes after the injury revealed small amounts of TIVHs in the frontal horn and body of bilateral lateral ventricles. High-density spots suggesting TICH in the right temporal lobe were noted (**FIGURE 1**). Repeat cranial CT scans were obtained 2 hours (**FIGURE 2**) and 7 hours (**FIGURE 3**) after injury revealed increased amount of TIVH in the bilateral lateral ventricles and a much clearer TICH in the right temporal lobe. His neurological examination remained unremarkable after admission and his headache was improved. Repeat cranial CT scans that were obtained 3 days later revealed that TICH still persisted in the right temporal lobe while TIVH had completely resolved (**FIGURE 4**). The patient was discharged after 7 days with no neurological deficits.

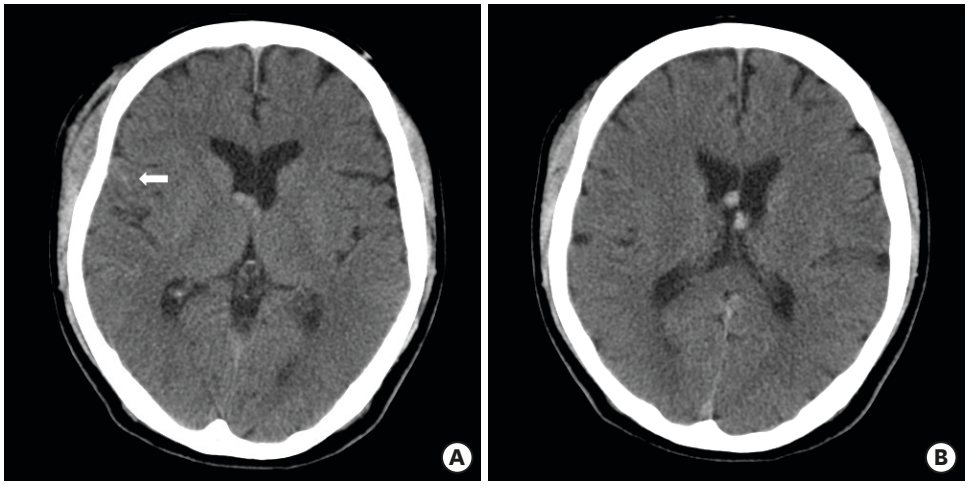

FIGURE 1. A cranial computed tomography scans performed 30 minutes after the injury reveal small amounts of traumatic intraventricular hemorrhages in the frontal horn and body of bilateral lateral ventricles. High-density spot suggesting traumatic intracerebral hemorrhage in the right temporal lobe are noted (white arrow).

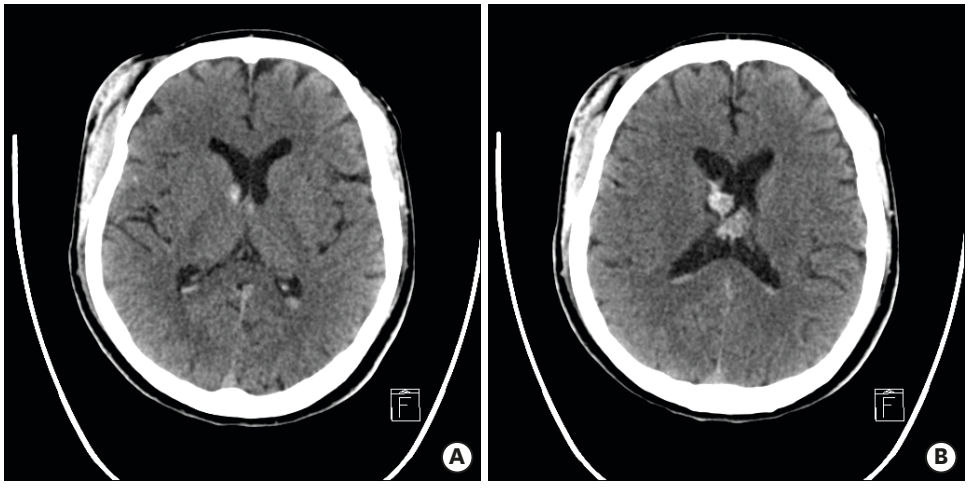

FIGURE 2. A repeat cranial computed tomography scan obtained 2 hours after the injury reveals increased amount of traumatic intraventricular hemorrhage in bilateral lateral ventricles and a much clearer traumatic intracerebral hemorrhage in the right temporal lobe.

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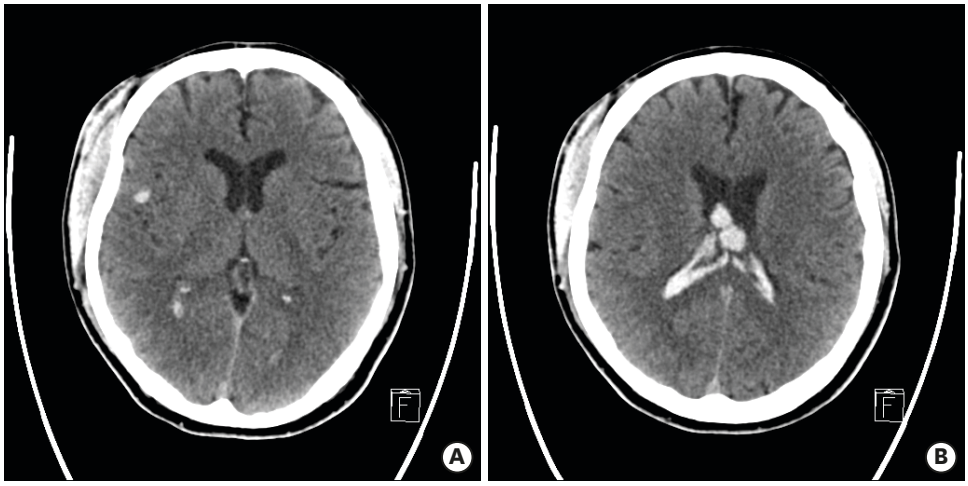

FIGURE 3. A repeat cranial computed tomography scan obtained 7 hours after the injury reveals increased amount of traumatic intraventricular hemorrhages in bilateral lateral ventricles and a traumatic intracerebral hemorrhage in the right temporal lobe.

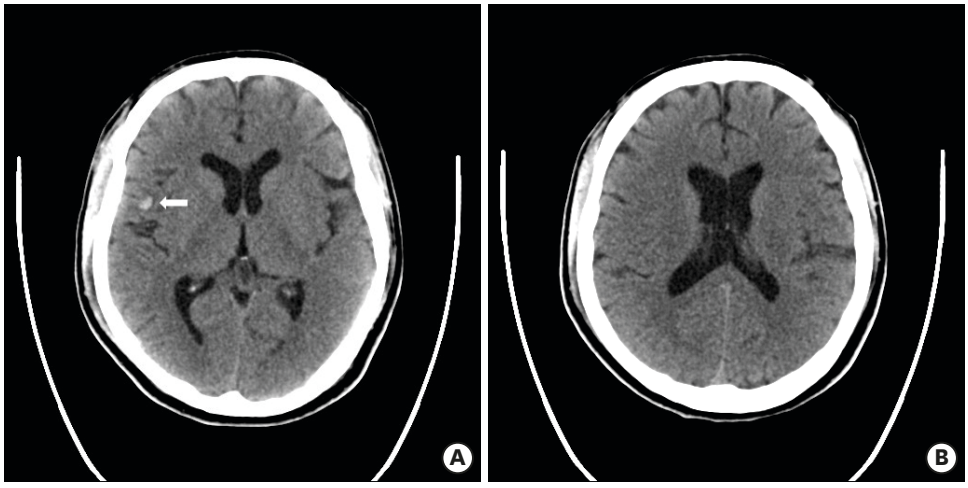

FIGURE 4. Repeat cranial computed tomography scan obtained 3 days after the injury reveals that the traumatic intracerebral hemorrhage still persisted in the right temporal lobe (white arrow) and traumatic intraventricular hemorrhages completely resolved.

DISCUSSION

Among the various types of TBI, there have been many reports of the rapid disappearance of TEDH.[1,2] Although the mechanism underlying the rapid resolution of a TEDH is still unknown, it seems clear that skull fractures play a key role in this process. Aoki[1] emphasized the potential for communication between intracranial spaces and epicranial hematomas through a fracture. Eom et al.[2] conducted a literature review of cases of spontaneous disappearance of an acute epidural hematoma (AEDH) within 24 hours. They assumed that the underlying mechanism of the disappearance of an AEDH is the redistribution of the hematoma through overlying skull fractures, rather than its resolution or absorption. In support of their hypothesis, other studies have reported higher spontaneous disappearance rates for patients with additional skull fractures compared to patients with isolated TEDH.[2] There are also a relatively large number of reports of rapid resolution of TSDH.[9-11] Wen et

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al.[11] summarized some of the characteristics common to most patients with rapid resolution of TSDH as follows: temporary coma not exceeding 12 hours, no cerebral contusion, widely distributed hematoma with a thin width, a low-density band between the skull and hematoma on cranial CT, and only a mild or moderate TBI (Glasgow Coma Scale >8 on admission). Several hypotheses have been proposed to explain the underlying mechanism of the rapid disappearance of TSDH, such as dilution of the TSDH caused by cerebrospinal fluid (CSF) flow through an arachnoid membrane tear.[6,7] A low-density band in the TSDH on CT appears to be caused by CSF coming from the subarachnoid space through a tear in the arachnoid membrane. It may also be possible to redistribute the hematoma to other subdural spaces or extracranial spaces through the skull fracture.[9,11] Faheem et al.[3] presented the case of a 2.5-year-old girl who showed spontaneous resolution of a TICH in the left frontal lobe with a contusion on a repeat CT scan performed 24 hours after the injury. They postulated that the pressure due to the cerebral edema and swelling around the TICH could tear the overlying pia mater, leading to drainage of the TICH into the subarachnoid space. In addition, although they did not speculate on the mechanism, Kurve and Mahapatra[7] reported that rapid resolution of a TSAH within 24 hours was accompanied by rapid neurological improvement.

When reviewing several previous case reports and the proposed mechanisms related to the rapid disappearance of various types of hematoma caused by TBI, there is no doubt that the presence of a drainage route, such as a skull fracture or tears of the arachnoid membrane or pia mater, plays a key role in this process. Many case reports have also suggested that the rapid disappearance of the hematoma is due to its redistribution through the drainage route, rather than its resolution or absorption. TIVH is a relatively rare type among TBIs. It has a poor prognosis because it is commonly observed in severe TBI and is often associated with other intracranial traumatic lesions.

Naff et al.[8] reported that the percentage rate of clot resolution was 10.8% per day after analyzing the CT scans of 17 adult patients with intraventricular hemorrhage (IVH). Although IVHs were non-traumatic, the rate of clot resolution was independent of initial clot volume, age, gender, the type of underlying hemorrhage, and use of extraventricular drainage. Both large and small amounts of hematomas tended to have the same half-life. Their study showed that resolution of hematoma during the first 48 hours after hemorrhage is governed by kinetics that are distinct from the kinetics that pertain to clot resolution after the initial 48 hours. During these initial 48 hours, 29.4% of the study population, demonstrated a greater than 5% increase in clot volume beyond their initial clot volume. After this initial 48-hour period, clot resolution seems to proceed at a constant percentage rate. The half-life of the clot is known to be 5.4 days.[8] A study reported that there was a 48-hour latency period after the initial IVH.[8] A substantial number of the blood clots actually expand in volume during this time. Although the mechanism of clot expansion and the cause of the latency period are uncertain, it seems that these processes conclude at 24 to 48 hours. In this patient, repeat cranial CT were obtained 3 days after head trauma showed complete resolution of IVH, which a case of very rapid resolution of clot in CSF.

Naff et al.[8] also found that the absolute rate of clot volume resolution was directly related to the initial clot volume and these results demonstrated that the enzyme-substrate system was responsible for the resolution of blood clots within the CSF. Clotted blood may persist in the ventricles for several reasons related to coagulation and fibrinolytic pathways in the ventricular system.[4,5] After neonatal IVH, tissue plasminogen activator may be demonstrated, but fibrinolytic activity often is not seen for several weeks after IVH and there appears to be

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insufficient concentrations of CSF plasminogen acutely.[4,5] Rapid immediate evolution of blood clot resolution in the ventricles therefore may be impaired by the fibrinolytic state of the CSF. It is possible that the saturation of the thrombolytic enzyme system in the CSF occurred within a relatively short time in this patient. We also supposed that the drainage route in TIVH was through CSF circulation. CSF is formed by the choroid plexus and passes through the ventricles into the subarachnoid space. CSF is absorbed through blood vessels over the surface of the brain back into the bloodstream and lymphatic system. Approximately 500 mL of CSF is produced daily and continuously replaces CSF that is absorbed. The author speculated that CSF circulation might play a critical role in rapidly diluting and redistributing hematomas.

CONCLUSION

The authors described a rare case of TIVH that disappeared rapidly within 3 days without surgical intervention. Although the exact pathogenic mechanism is unclear, we believe that the thrombolytic enzyme system in the CSF or circulation of CSF plays an important role in the rapid resolution of the TIVH. Further research is warranted to clarify this rare phenomenon.

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