Transient obstructive hydrocephalus due to intraventricular hemorrhage: A case report and review of literature

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Introduction

While obstructive hydrocephalus is a relatively common and potentially life-threatening condition, transient obstructive hydrocephalus is a rare condition in adults. Transient obstruction of cerebrospinal fluid (CSF) flow through the ventricular system has been reported to result from systemic causes such as lead and carbon monoxide poisoning as well as CNS infections and meningitis. Previous case reports have also described spontaneous resolution of obstructive hydrocephalus after intraventricular hemorrhage (IVH) in neonates and adults. Herein we report a 33-year-old male with a large arteriovenous malformation (AVM) who presented with a small IVH and subsequently developed transient acute hydrocephalus.
mitted to the neurosurgical intensive care unit (ICU) for close observation. A catheter angiogram and MRI scan obtained on the following morning revealed no change in the AVM (Fig. 2).

A repeat head CT scan on the second day of hospitalization demonstrated stable IVH without ventriculomegaly. The patient was then transferred from the ICU to the neurosurgical ward for observation.

Approximately 40 hours after initial presentation, the patient experienced severe headache with associated nausea. An urgent CT scan revealed the interval development of hydrocephalus, with the suggestion that a portion of the intraventricular thrombus had migrated from the left lateral ventricle to the junction of the third ventricle and the cerebral aqueduct (Fig. 3). There was no recurrence of IVH or subarachnoid hemorrhage. The patient was immediately transferred back to the ICU with anticipation of a need for ventriculostomy placement.

Shortly thereafter his headache began to improve. On examination the patient appeared more comfortable and was not lethargic. He remained without focal neurological deficits. The headache resolved within 4 hours of onset. A ventricular drain was not placed, and the patient was monitored. Head CT performed 6 hours after the onset of headache and the first CT revealing hydrocephalus, showed an interval decrease in the ventricular size and further clot migration through the cerebral aqueduct (Fig. 4). There were no further clinical events during the hospital stay and the patient was discharged without further sequelae from his transient hydrocephalus.
Discussion

Obstructive hydrocephalus is common after IVH due to obstruction of normal CSF flow and absorption by the thrombus. The presence of clinically significant ventricular dilatation in this condition typically requires external ventricular drainage for an extended period, and may ultimately necessitate ventricular shunting. A delayed development of acute but transient obstructive hydrocephalus is unusual in this patient population. Our patient experienced acute development of hydrocephalus approximately 48 hours after the onset of symptoms of IVH, and this resolved spontaneously over 6 hours.

From our case and a review of the literature, it appears that acute hydrocephalus subsequent to aqueductal obstruction by a migratory clot can present in two ways. In the first situation the hydrocephalus develops soon after the ictal event and the patient may actually present with the symptoms of acute hydrocephalus.1-7 It this situation, it is possible that areas of the intraventricular clot may begin to break away before the clot becomes organized and hardens, with these fragments subsequently migrating along the direction of CSF flow leading to obstruction soon after the initial hemorrhage. In the second situation, of which our case is an example, there is a period of stability after the initial hemorrhage followed by sudden clinical deterioration and the development of hydrocephalus due to aqueductal obstruction by a migrating clot.8,9 The delayed development of hydrocephalus in our patient may be explained by the natural time course of clot dissolution by the fibrinolytic activity of CSF, which is increased after IVH;10,11 however, this increase is not sufficient for rapid and complete

Fig. 3. A and B: Axial CT scan obtained 40 hours after presentation reveals the interval development of hydrocephalus with suggestion that a portion of the intraventricular thrombus had migrated from the left lateral ventricle to the junction of the third ventricle and cerebral aqueduct.

Fig. 4. A and B: Axial CT scan obtained approximately 6 hours after the development of hydrocephalus reveals resolution of the hydrocephalus and disappearance of the third-ventricle clot.
resolution of a clot.\textsuperscript{10,12} We speculate that the increased fibrinolytic activity in our case could have contributed to partial breakdown of the existing third-ventricle clot producing a mobile fragment, which migrated in the direction of CSF flow and was large enough to lodge at the aqueduct, resulting in acute obstructive hydrocephalus. Thus, it is important to consider this possibility when making observational and discharge decisions in patients with IVH, and especially when patients who are discharged after IVH return to the hospital with the sudden onset of symptoms associated with elevated intracranial pressure.

Another interesting aspect of our case is the spontaneous clearing of the clot from the aqueduct and resolution of hydrocephalus, which contrasts with most cases of acute hydrocephalus having to be relieved by CSF drainage. In our case it is likely that the ongoing fibrinolytic activity of the CSF made the obstructing clot fragment fragile, thus allowing the increased intraventricular pressure and hyperdynamic CSF flow resulting from acute obstruction\textsuperscript{13} to break down the clot fragment further and permit its passage through the aqueduct, relieving the acute hydrocephalus. Also, proximal aqueductal dilatation, which has been observed in cases of acute hydrocephalus, may have further facilitated the passage of the clot. While spontaneous passage of a clot obstructing the aqueduct occurred in our patient and in four other cases,\textsuperscript{4-6,14} it did not occur in other reported cases, thereby necessitating CSF drainage in those patients.\textsuperscript{7,9} Therefore, when patients present with acute hydrocephalus due to aqueductal obstruction by a clot, CSF drainage should be performed immediately (as is done routinely) without waiting for spontaneous resolution.

In conclusion, patients with IVH may develop acute or delayed obstructive hydrocephalus. While most cases of clinically significant hydrocephalus require CSF drainage, in rare situations the hydrocephalus may resolve spontaneously due to fibrinolysis and clot migration, as observed in our patient.

Conflicts of Interest
The authors have no financial conflicts of interest.

REFERENCES