

# Fast resolution and good outcomes of isolated traumatic intraventricular haemorrhage: a case report

Mohamed M. Ali<sup>1</sup>, Ali H. Elbasuny<sup>1</sup>, Mostafa Meshref<sup>2</sup>, Odai Hamed Al-ma'aitah<sup>3</sup>, Eshak I. Bahbah<sup>4</sup>

<sup>1</sup>Neurology Department, Al-Azhar University Hospital, Damietta, Egypt, <sup>2</sup>Al-Azhar University, Cairo, Egypt, <sup>3</sup>School of Nursing and Midwifery, Faculty of Health, University of Technology Sydney, Ultimo, NSW, Australia, <sup>4</sup>Faculty of Medicine, Al-Azhar University, Damietta, Egypt

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## Abstract

*The location and the size of intracranial haemorrhage play an important role in determining the time for the hematoma resolution. Without surgical intervention, it takes at least a few weeks for the whole hematoma to resolve spontaneously. Despite that the rapid and spontaneous resolution of intracranial haemorrhage is well described in the literature, it is considered rare. Moreover, we could identify only one case of rapid spontaneous resolution of isolated traumatic intraventricular haemorrhage (ITIVH) in the literature. Herein, we report a rare case of ITIVH that disappeared rapidly without surgical intervention. Our case supported the hypothesis that the cerebrospinal fluid (CSF) and its circulation are major players in the rapid resolution of ITIVH.*

**Key words:** intraventricular haemorrhage, intracranial haemorrhage, haemorrhagic stroke, cerebrospinal fluid, case report.

## Introduction

Isolated traumatic intraventricular haemorrhage (ITIVH) term is used when intraventricular haemorrhage (IVH) is restricted to the ventricular system and caused by head trauma. It is an extremely rare entity, representing less than 5% of all cases of isolated IVH [13]. It is more common in the paediatric population than in adults. Studies conducted to report its incidence concluded different incidence rates ranging from 0.4% to 4.0% in all traumatic head patients [7,8,10]. Atzema *et al.* conducted their prospective multicentre study over 8374 patients with head trauma, and they found that the prevalence of isolated traumatic intraventricular haemorrhage was 1.4% [1]. They reported

an overall poor outcome in 70% of patients. Poor outcomes were associated with a low Glasgow coma scale (GCS; especially less than 8), including the presence of haemorrhage inside the third or fourth ventricles, and the presence of other major injuries in the brain. On the other hand, patients with true isolated IVH were associated with a better outcome.

True isolated IVH is defined by the presence of only intraventricular haemorrhage on both initial and follow-up computed tomography (CT) scans, except for basal ganglia contusion [1]. Isolated IVH can be caused by severe trauma adequate to cause shearing of subependymal veins present in the fornix, septum pellucidum, or choroid plexus [11,17].

## Communicating author:

Eshak I. Bahbah, Faculty of Medicine, Al-Azhar University, Damietta, Egypt, 34511, phone: +201094919098, e-mail: [Isaacbahbah@gmail.com](mailto:Isaacbahbah@gmail.com)

Other causes of isolated IVH are vascular pathologies, arteriovenous malformation (AVM), aneurysm, cavernous malformation, Moyamoya disease, vasculitis, trauma, surgery, and recirculation of subarachnoid haemorrhage (SAH) tumour. Predisposing factors include arterial hypertension, coagulopathy, anticoagulation, and sympathomimetic abuse [2]. In more than 25% of cases, the cause cannot be reached, despite meticulous search [9,15].

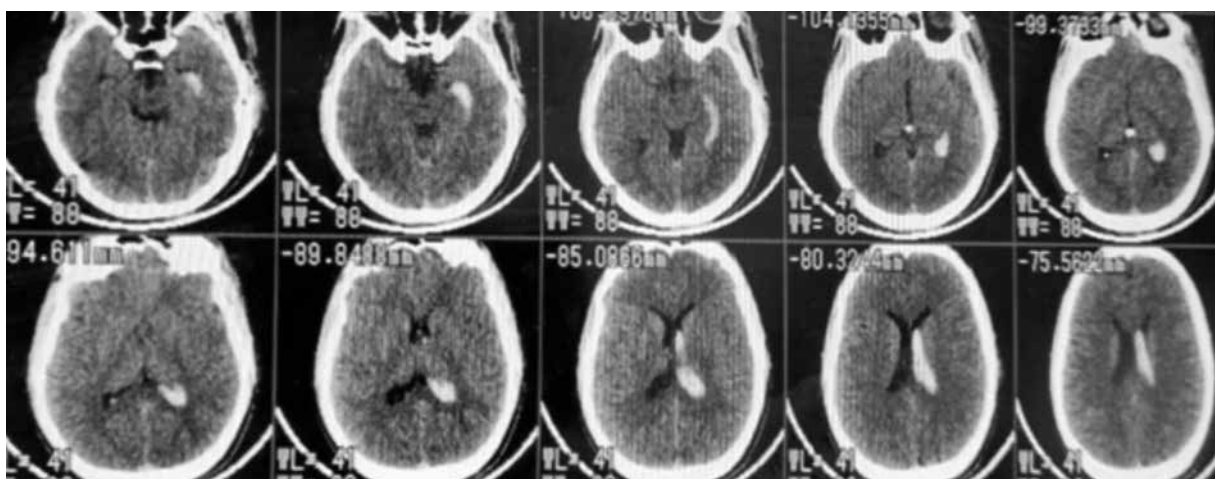
Isolated traumatic IVH is most commonly restricted to the lateral ventricle; however, it may also affect the third and fourth ventricles in isolation or combined with the lateral ventricle [2]. Despite the fact that it is intraventricular, it rarely causes hydrocephalus [3,11,13,17]. Early diagnosis of IVH can be attained by CT scan [11]. Depending on the site of haemorrhage, we can divide haemorrhage attributable to traumatic brain injury into five categories: traumatic intracerebral haemorrhage (TICH), traumatic epidural hematoma (TEDH), and traumatic intraventricular haemorrhage (TIVH), traumatic subarachnoid haemorrhage (TSAH), and traumatic subdural hematoma (TSDH). These five forms can develop in isolation or combined with each other. Despite the fact that the time required for resolving these forms of a haemorrhage depends on the amount of bleeding, in the absence of surgical intervention, it takes weeks or even months for spontaneous resolution [4,11]. Herein, we present a case with isolated traumatic intraventricular haemorrhage with rapid disappearance in a few days and excellent outcome.

## Case presentation

A 25-year-old man was admitted to the neurology department following a road traffic accident. At the time of admission, his GCS was E3 M5 V4, and his pupils were mid-sized, equal, and well reacting to light. There was no focal neurological deficit on examination. He had insignificant medical and surgical histories. On admission day, anti-oedema and phenytoin, as prophylaxis for seizures, were started. Initial CT on admission, one hour after the accident, revealed an isolated intraventricular haemorrhage in the left lateral ventricle without hydrocephalus (Fig. 1). CT angiography was performed 2 days later in order to rule out any vascular pathology. There were no identified vascular or tumoral lesions (Fig. 2). The conscious level improved until the patient became fully conscious on the 5<sup>th</sup> day after admission and the patient had no focal neurological deficits. CT brain performed on the 4<sup>th</sup> day of admission revealed complete resolution of the intraventricular haemorrhage (Fig. 3). The patient was discharged after six days. Then the patient has been arranged to have elective conventional cerebral angiography, which revealed no vascular abnormalities (Fig. 4).

## Discussion

It is established in the literature that TEDH may undergo rapid spontaneous resolution, which may be related to the associated fracture. This may be not related to the absorption itself but to the hema-



**Fig. 1.** Non-contrast computed tomography (NCCT) shows isolated intraventricular haemorrhage restricted to the left lateral ventricle.

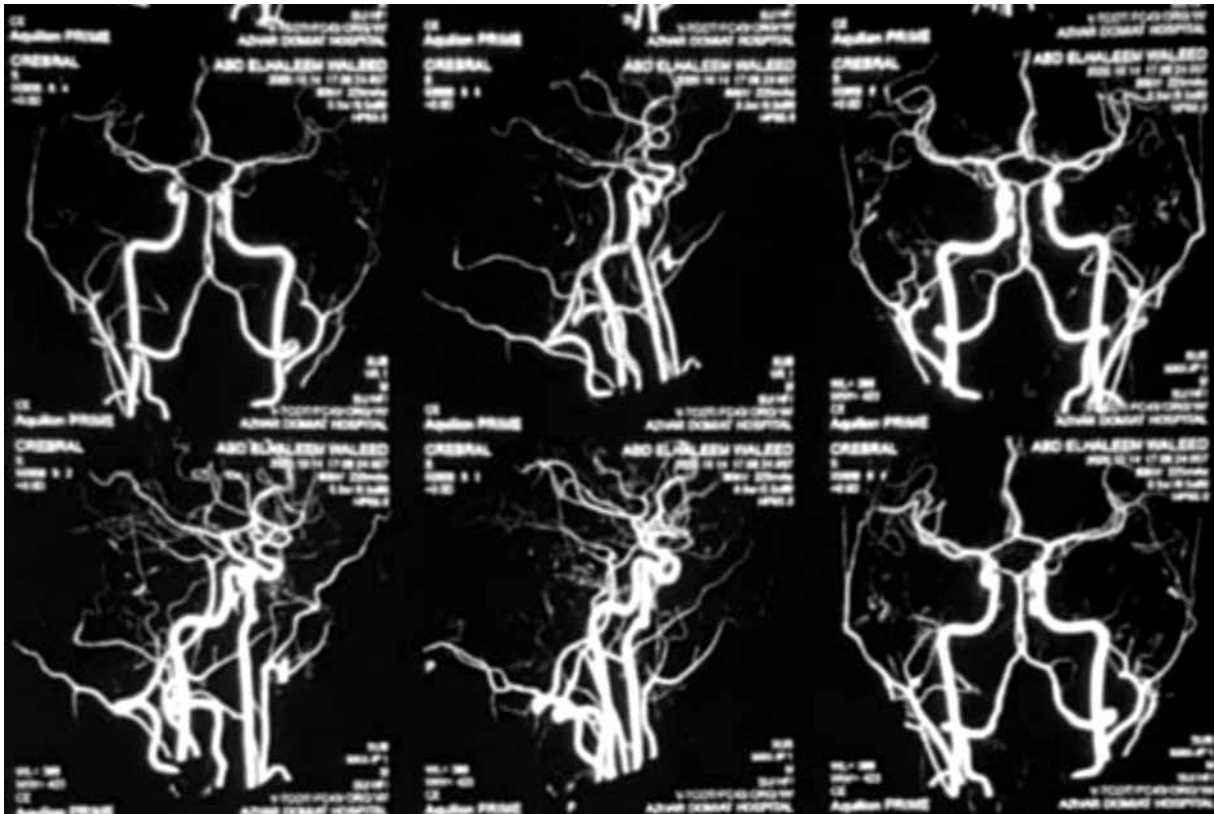


Fig. 2. Computed tomography angiography (CTA) shows no detected abnormalities.

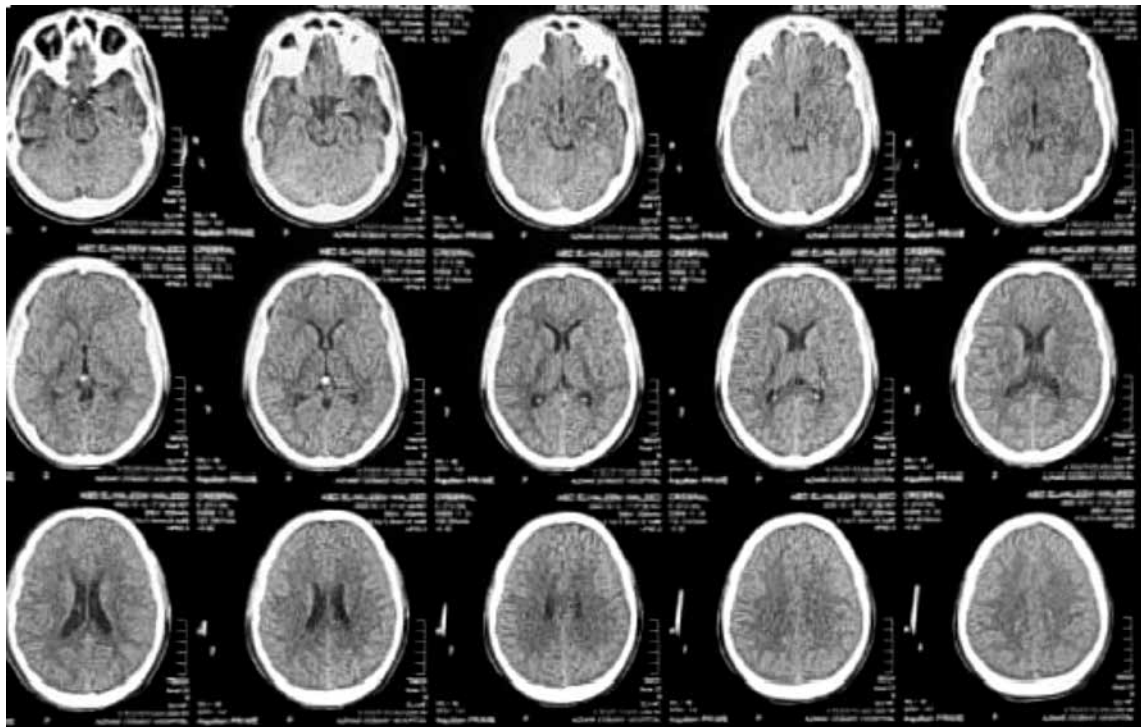
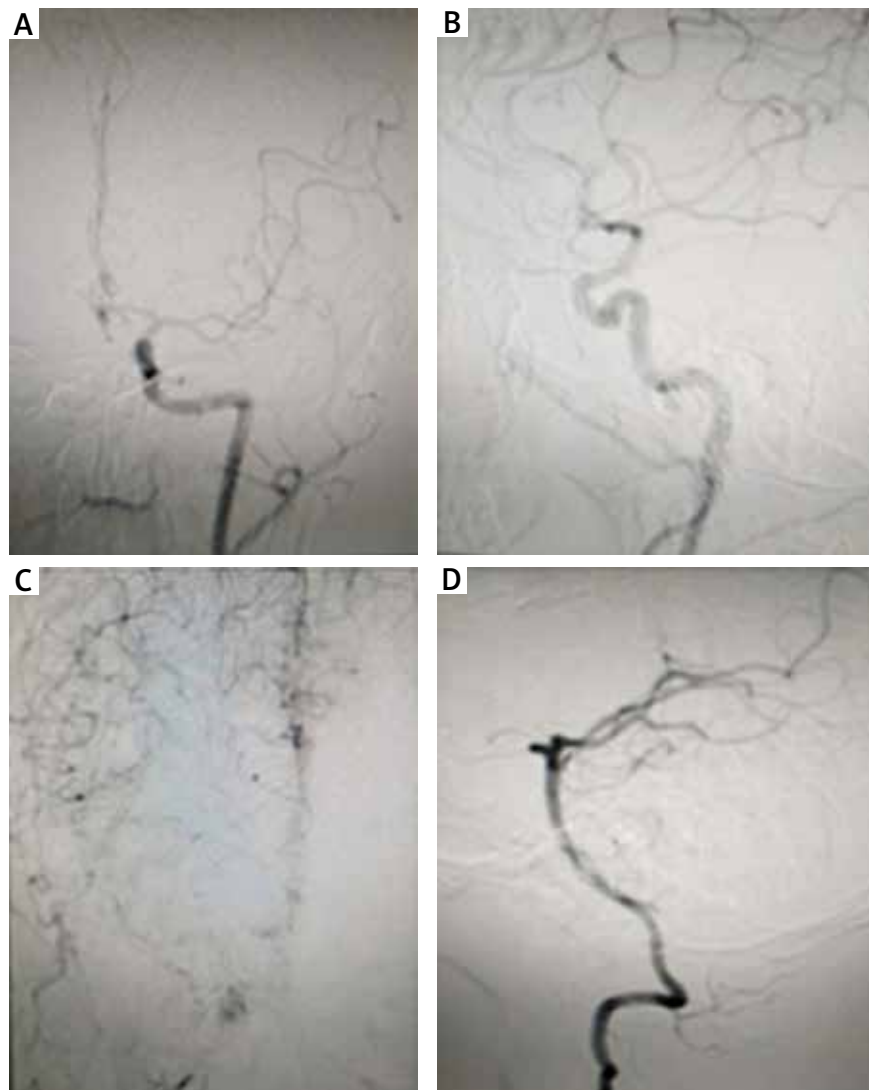


Fig. 3. Non-contrast computed tomography (NCCT) shows resolved intraventricular haemorrhage (IVH) on the 4<sup>th</sup> day of admission.



**Fig. 4.** **A)** Digital subtraction angiography (DSA) shows normal left internal carotid artery, and terminal branches of anterior cerebral artery and middle cerebral artery. **B)** DSA shows normal lateral view of the internal carotid artery. **C)** DSA shows a normal capillary phase of the right internal carotid artery. **D)** DSA shows normal vertebrobasilar artery and both posterior cerebral arteries.

toma redistribution via the overlying fracture. This may be supported by the observation that patients with TEDH associated with skull fractures have more rapid hematoma resolution than those with TEDH without associated fractures [4]. It is also established, to a lesser extent, that TSDH may undergo spontaneous resolution. This also may be not related to the absorption itself but to the hematoma dilution by leaked cerebrospinal fluid (CSF) through disrupted arachnoid granulation [11,12]. This may be supported by the observation of a lower density of

hematoma in the case of TSDH [16,18,19]. We also identified a case of TICH with rapid spontaneous resolution [5]. However, we identified only one case report in the literature with rapid resolution of TIVH without surgical intervention. As a conclusion of reviewing many studies discussing the route and mechanisms, hypotheses explaining the spontaneous resolution of traumatic intracranial haemorrhage include extracranial drainage through associated skull fracture and/or disrupted arachnoid and pia membranes.

A study analysed CT scans of 17 patients with non-traumatic IVH to study the nature of hematoma resolution. They found that the clot resolution rate was not dependent on the initial volume of the hematoma. The rate of drainage was 10.8% per day. Kinetics for drainage of hematoma was different within the first 48 hours after the drainage. Approximately 29.4% of patients had an increased haemorrhage by more than 5% in the first 48 hours. After the initial possible clot expansion, the clot resolves at a constant rate of 10.8%, with a half-life of 5.4 days. There was a complete resolution of IVH at the follow of CT scan on the fourth day of admission in our patient. The absolute rate of the resolution was dependent on the initial volume of haemorrhage, which supports the hypothesis that the system responsible for IVH is the enzyme-substrate system within the CSF [14].

We identified only one case in the literature of isolated traumatic intraventricular haemorrhage with rapid spontaneous and complete resolution reported by Ki Seong Eom [5]. The authors support the hypothesis released by Ki Seong Eom that the CSF has a significant role in rapid dilution and redistribution of hematomas.

In conclusion, we have reported an extremely rare case of ITIVH with spontaneous and rapid disappearance within four days. Despite the ambiguity of that rapid and spontaneous resolution's underlying mechanism, we think that its thrombolytic enzyme system has a critical role in such rapid resolution in the CSF or circulation. More research is needed to explain this rare phenomenon.

## Consent

The patient's consent was obtained for the publication.

## Disclosure

The authors report no conflict of interest.

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