

SHORT REPORT

Intracerebral haemorrhage due to amphetamine abuse: report of two cases with underlying arteriovenous malformations

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Abstract

Amphetamine abuse may be complicated by intracerebral, subdural or subarachnoid haemorrhage. The causative mechanism is probably a combination of vasculitis and induced hypertension. Most cases of intracerebral haemorrhage are subcortical. Only one case of amphetamine-induced intracerebral haematoma where there was also an underlying arteriovenous malformation has been previously reported. We report two cases of intracerebral haematoma due to amphetamine abuse where an underlying AVM was found at the time of surgery. This possibility should be considered in cases of amphetamine-induced intracerebral haemorrhage.

Key words: Amphetamine, arteriovenous malformation, intracerebral haemorrhage.

Introduction

Intracranial haemorrhage due to amphetamine abuse is uncommon, but well documented.¹⁻¹⁵

It may take the form of intracerebral, subdural or subarachnoid haemorrhage.^{1,2,4,7,9,12,13} The mechanism is probably a combination of hypertension induced by the sympathomimetic amine and cerebral vasculitis.^{6,7,11} Evidence of vasculitis has been demonstrated pathologically^{7,11,12} and angiographically.^{1,8,11} One case in the literature was of an intracerebral haemorrhage due to amphetamine abuse where there was an associated underlying vascular malformation and no evidence of vasculitis in the specimen.⁷

We present two cases of intracerebral haemorrhage (ICH) associated with amphetamine abuse which are of significance because they both demonstrated an underlying vascular anomaly. Angiography was negative in one case and not performed in the other, but the

presence of an arteriovenous malformation (AVM) was confirmed histopathologically in both.

Case reports

Case 1

A 21-year-old Caucasian woman was found collapsed and unable to speak or to move her right side. The previous evening she had taken 'Ecstasy', a hallucinogenic amphetamine (3,4 methylene dioxymethamphetamine or MDMA), following which she became agitated and behaved strangely before going to bed. She also took cannabis later in the evening. She had taken 'Ecstasy' three times in the previous year and had taken cannabis occasionally for 3 years. Examination revealed her to be conscious, aphasic, with bilateral papilloedema and a right hemiparesis worse in the arm than the leg. Computed tomography



FIG. 1. Case 1. Axial unenhanced CT scan showing the left frontal intracerebral haematoma.

(CT) of the head showed a left frontal intracerebral haematoma with mass effect and midline shift (Fig. 1). Carotid angiography did not show any underlying vascular abnormality. Craniotomy to evacuate the haematoma revealed a small area of abnormal vessels on the cortical surface fed by a large branch from the anterior cerebral artery. This was excised. Histological examination revealed blood vessels of varying diameter and wall thickness. The walls of some of these vessels contained elastic lamina, but in others it was absent. The appearances were those of a vascular malformation (Fig. 2). She made a slow recovery, but regained full function and speech.

Case 2

A 19-year-old negro girl complained of sudden headache and vomiting following a party at which she took methamphetamine, a drug which she had taken on a recreational basis

occasionally for several months. Soon afterwards she developed a left-sided weakness. She had had migrainous headaches for a few months, but otherwise she had been previously well. Examination revealed her to be conscious and orientated, with a left facial weakness and a complete left hemiplegia. Sensation was normal. CT revealed a right-sided frontoparietal intracerebral haematoma with evidence of subarachnoid extension (Fig. 3). A craniotomy was performed to evacuate the haematoma. A small area of vessels in the wall of the cavity was excised. Histopathological examination demonstrated areas of haemorrhage and also blood vessels of varying luminal diameter, some thin-walled and others with elastic laminae in their walls. The appearances were those of an AVM (Fig. 4). She had good return of function on the left.

Discussion

Amphetamine was introduced in 1935 as a therapeutic agent and has been used to treat narcolepsy, obesity, hypotensive states, depression, behaviour problems in children and epilepsy.⁹ Thirty years ago it was available without prescription as the preparation Benzedrine and was used as a stimulant.¹⁰ Today, available in oral, nasal and intravenous forms, it is more commonly used illicitly as a 'recreational' drug.^{6,15}



FIG. 2. Case 1. Sections taken through the haematoma, stained with Elastic Van Gieson, showing numerous blood vessels of varying size and luminal diameters. The stain shows elastic lamina in the wall of the individual vessels ($\times 33$).



FIG. 3. Case 2. Axial unenhanced CT scan showing the right frontal intracerebral haematoma.

Intracranial haemorrhage can occur with amphetamine used in any of its forms, irrespective of the dose and duration of usage. Cases have been reported of haemorrhage following low and single doses^{3,6,10} and following therapeutic usage as well as abuse.⁶ The ages of reported cases range from 16 to 60 years



FIG. 4. Case 2. A photomicrograph of a section through the haematoma. Within the haematoma are vessels of varying size and shape. A large vessel with elastic lamina in its wall is shown ($\times 20$).

with a mean of 33 years^{2,6} and a male preponderance of 4 to 1.^{6,15}

Cerebral vasculitis has been well described in relation to amphetamine usage.^{7,11,12} The early changes are fibrinoid angiitis, necrosis of the media and intima, and a leucocytic infiltrate. There is marked intimal proliferation. Later collagen replaces muscular and elastic tissue, and the vessel wall is narrowed, occasionally with nodular aneurysmal dilatation. Medium and small arterioles are involved. When there is intracranial haemorrhage (ICH) the site tends to be subcortical rather than the capsule which would be expected from a hypertensive bleed. Thus, of 14 reports of ICH, only five were capsular, the remainder being frontal, temporal or parietal.^{2,3,5,8,11,13-15}

The role of hypertension in the haemorrhage is uncertain. Amphetamine has sympathomimetic effects and since most instances of ICH occur within minutes of a dose presumably hypertension is usually the precipitating cause. Hypertension has been recorded after taking amphetamine.¹⁰

The clinical presentation of amphetamine overdose or abuse may consist of mental effects such as euphoria, increased cerebral activity, confusion, feeling of detachment and psychotic states,¹⁰ symptoms which may overlap with the effects of the intracranial haemorrhage such as severe headache, nausea and vomiting. The patient may be alert or confused and comatose with commonly a unilateral weakness of the limbs.^{6,10} Seizures are a less common feature with amphetamine abuse than with cocaine abuse, although two cases have been reported.^{5,15}

Computed tomography (CT) will show the haemorrhage. Cerebral angiography characteristically shows irregularity and beading of the vessels due to the vasculitis^{2,5,6,10,15} which, in most cases, affects the anterior and middle cerebral arteries. The changes have been shown to resolve following steroid therapy.^{11,15}

Treatment of ICH is dependent on the clinical state of the patient. Comatose and moribund patients will require surgical evacuation whereas alert patients with minor deficits

have been reported who have been treated conservatively. Although the mortality is reported to be about 50%² it is less than for hypertensive ICHs probably because amphetamine-related ICH tends to be within subcortical white matter and therefore carries a more favourable prognosis than hypertensive haemorrhages which more typically occur in basal ganglia, pons and cerebellum.⁶

In only one instance has the presence of an underlying AVM in an amphetamine-induced ICH been reported.⁷ In this case a temporal ICH followed an intravenous amphetamine dose and an AVM was demonstrated angiographically. The malformation was excised, but there was no evidence of vasculitis within the specimen.

In the first of our cases the angiogram was normal and in the second an angiogram was not performed. However, an AVM was found and pathologically confirmed in both cases and negative angiography need not exclude the presence of an AVM. We would therefore recommend that the possibility of an underlying AVM be considered in cases of ICH due to amphetamine abuse.

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