

# **Subcortical Hemorrhage Caused by Methamphetamine Abuse: Efficacy of the Triage System in the Differential Diagnosis**

## **—Case Report—**

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### **Abstract**

A 32-year-old woman was brought to the emergency room with hemiplegia on the left and consciousness disturbance. Her prior medical history and the circumstances of the onset were unknown. Brain computed tomography showed intracerebral hemorrhage (ICH) with a midline shift of more than 10 mm in the right parietal lobe. Cerebral angiography failed to show any vascular anomalies. Urine analysis with the triage system, a qualitative screening test for psychotropic drug abuse, showed positive reaction for amphetamines. Subsequent laboratory examination confirmed a highly elevated serum concentration of methamphetamine. The patient underwent evacuation of the hemorrhage via a craniotomy, and was discharged 40 days after admission. Abuse of illegal drugs including amphetamines among young adults is increasing in many developed countries, and the suspicion of possible drug abuse should always be raised in young patients with angiographically negative ICH. A urinalysis screening test for psychotropic agents should be a part of routine emergency room diagnostic procedures for such patients.

Key words: drug abuse, intracerebral hemorrhage, methamphetamine, triage system

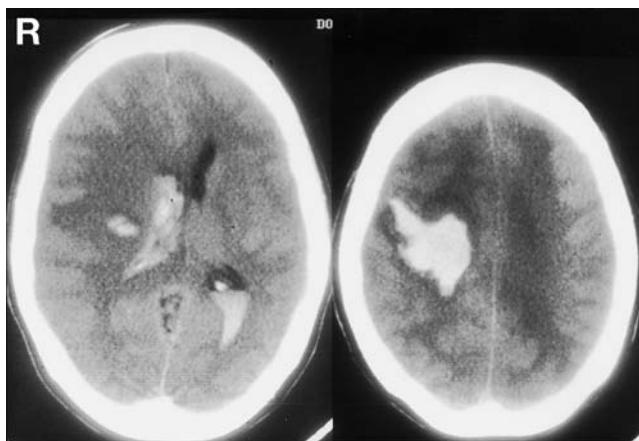
### **Introduction**

Abuse of amphetamines is well known to be associated with various cerebrovascular accidents, including intracerebral hemorrhage (ICH) and subarachnoid hemorrhage.<sup>1,3,6)</sup> Acute neurological deterioration in young adults with a known history of chronic drug addiction is indicative of the correct diagnosis. However, identification of amphetamines as a cause of ICH is often difficult in comatose patients, particularly if information regarding their medical and social backgrounds cannot be obtained from family members or witnesses. We treated a young woman with a subcortical hemorrhage in the right parietal lobe, who presented in the emergency room with consciousness disturbance. The triage system (Biosite Diagnostics, San Diego, Calif., U.S.A.), a urinalysis screening kit for detecting abuse of various psychotropic drugs, was effective

for detecting methamphetamine in the urine and establishing the diagnosis.

### **Case Report**

An unmarried 32-year-old woman, who was found by a friend to be comatose in her room, was transferred to the emergency room by ambulance. Her "friend" mysteriously disappeared soon after admission, so no information regarding mode of onset of her symptoms or her past medical history could be obtained. On admission, her blood pressure was 135/85 mmHg, and she had a regular respiratory pattern. Her level of consciousness was E1V2M5 on the Glasgow Coma Scale. She had hemiplegia and increased deep-tendon reflexes on the left. Her pupils were equally mydriatic, 4.5 mm in diameter, but were reactive to light stimuli. Brain computed tomography showed subcortical hemorrhage with a midline shift of more than 10 mm in the right parietal lobe (Fig. 1). Cerebral angiography was performed immediately to search for the source of the



**Fig. 1** Brain computed tomography scans showing subcortical hemorrhage with a midline shift of more than 10 mm in the right parietal lobe.

bleeding, but failed to show any vascular anomaly or venous outflow compromise.

She underwent emergency evacuation of the hematoma via a craniotomy. No abnormal vessels were encountered intraoperatively. A urine sample taken on admission was tested with a triage system, a urinalysis screening kit for the detection of drug abuse, and the sample was positive for amphetamines. Measurement of the serum sample collected at the time of admission revealed a highly toxic concentration of methamphetamine (120 ng/ml). She regained consciousness 2 days after surgery. She admitted that she had injected methamphetamine intravenously before she became unconscious, although she was not a chronic addict. She was discharged to a rehabilitation hospital 40 days after surgery, with residual hemiparesis on the left.

## Discussion

Amphetamines (particularly methamphetamine sold as "crank," "speed," or "ice")<sup>5)</sup> are potent psychotropic stimulants of which use is strictly restricted in the United States, Europe, and Japan. Illegal consumption has become widespread recently, and young adults are often vulnerable to chronic addiction. Neurosurgeons and emergency physicians are well aware that cocaine and amphetamine abuse occasionally cause intracranial bleeding, particularly in the form of ICH.<sup>1-3,6)</sup> A retrospective study performed in the State of California showed that as many as 73 among 214 patients (34%) with hemorrhagic or ischemic stroke aged 15 to 44 years were abusers of cocaine, heroine, and amphetamines.<sup>2)</sup>

The mechanisms of action of amphetamines as a cause of ICH may involve acute arterial inflammation (arteritis) and a sharp rise in blood pressure due to the sympathomimetic effect.<sup>4,6,7,10)</sup> Most cases of ICH have occurred in patients with a known clinical history of amphetamine abuse.<sup>4,6,7,10)</sup> The onset of ICH is usually acute, i.e., within several hours after the use of amphetamines, and the frequency of drug abuse increases the risk of the hemorrhage, although some patients sustained ICH after their initial use of amphetamines.<sup>4,6,7,10)</sup> To raise the suspicion of illegal drugs as causative agents in young, previously healthy patients presenting with progressive neurological deficits is often difficult, especially if no family members or witnesses are available to report the possible use of such drugs. Laboratory testing to search for psychotropic drugs in young, non-hypertensive patients with ICH may not be a common neurosurgical practice, even after angiographic evaluation yielded negative findings.

The triage system is a qualitative urinalysis screening test for the abuse or overdose of various psychotropic agents including barbiturates, benzodiazepines, cocaine, and amphetamines. Introduction of this system into the emergency room in recent years has facilitated the differential diagnosis of patients who present with consciousness disturbance.<sup>8)</sup> The false-positive or false-negative rates are not negligible, but the test is relatively reliable if followed by more quantitative gas chromatography/mass spectrometry analysis.<sup>8)</sup> The half-life of methamphetamine in humans is 4 to 5 hours, so the urine or blood sample should be collected and submitted to the laboratory within the day of admission.<sup>6)</sup>

Cerebral angiography should be the primary examination for young patients with ICH to detect possible vascular anomalies, and the triage system is particularly efficacious in patients without angiographical abnormalities. Although it is not clear whether the triage system is indicated for all young patients with ICH prior to angiography, conducting the test requires less than 10 minutes, and the test is easily performed in the emergency room or in the neurosurgical wards. A positive triage test cannot deny the presence of underlying vascular anomaly, as a recent series in the U.K. showed that most young patients with ICH caused by amphetamine abuse had vascular anomalies revealed by angiography.<sup>3)</sup>

Neurological examination is equally important in raising the suspicion of amphetamine abuse. Bilateral mydriasis reactive to light stimuli may suggest over-activation of the sympathetic nerves, and suggest the possibility of amphetamine abuse. In our

case, the route of methamphetamine intake was intravenous injection. ICH in young amphetamine addicts is usually a consequence of intravenous injection of the drug,<sup>2,3)</sup> although ICH caused by oral ingestion or inhalation of amphetamines has been reported.<sup>9)</sup>

In summary, the urinalysis screening test for psychotropic agents including amphetamines should be included in the emergency room diagnostic process for young, non-hypertensive patients with ICH but no angiographical abnormalities.

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