

Methamphetamine intoxication and related emergency situations

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A 19-year-old male arrives by ambulance at the emergency department with a chief complaint of polysubstance abuse. He has been camping with friends for the past three days, during which he apparently consumed quantities of alcohol, Ecstasy, 'mushrooms' and crystal methamphetamine. His friends had called an ambulance after the patient was found unresponsive. On arrival, the patient was combative, verbally abusive, dehydrated, cold and wet. He was reported to have not slept for the past three days. During his 12-hour stay in the emergency department, he required respiratory support, intravenous fluids, benzodiazepines, physical restraints and close monitoring. He was discharged in the care of his father. Clinical management of patients with polysubstance abuse can be complicated, especially if the patient history is vague. This article will focus on acute methamphetamine intoxication and related emergency situations surrounding this drug.

Methamphetamine is a psychostimulant. It currently belongs to a diverse group of illicit, synthetic drugs known as "club drugs". These substances arrived on the social scene in the 1990s and were named such due to their association with raves and dance parties. The drugs were used primarily to enhance the experience through the distortion of light, motion, sound and time. Club drugs have been gaining popularity because it is believed that they are not as dangerous or addictive as other drugs. In fact, club drugs can be especially risky because they are often manufactured in unsanitary, makeshift laboratories, making it virtually impossible for the user to know the exact contents, quality and potency of the drugs (Students Against Destructive Decisions, 2003). In North America, methamphetamine is largely produced in clandestine laboratories, many of which are located in rural areas and controlled by organized crime. Secret labs have been found in homes, garages, apartments, sheds, barns, hotel rooms, and even the trunks of cars. Individuals also make the choice to become 'meth cookers' to supply the drug for themselves and their friends. Recipes can easily be found on the internet. Common ingredients such as pseudoephedrine, drain cleaner and batteries can be purchased at local hardware stores and pharmacies.

Table One: Brief history of methamphetamine

(Hoecker, n.d., Walton, 2001, Derlet & Albertson, n.d.)

Year	Development
1880s	Documentation of a substance made from ephedrine, an organic substance used as a medicine in China for centuries
1919	Japanese pharmacologist first synthesized methamphetamine
1932	Sold in the U.S. as an inhaler for treatment of rhinitis and asthma
1937	Release of a report stating amphetamine could enhance intellectual performance through enhanced wakefulness
1930s-40s	First epidemic of methamphetamine abuse in Japan. Used by Allied and Axis troops to improve soldier's performance during WW 2
1960s	Second epidemic of methamphetamine abuse amongst students, athletes, shift workers, truck drivers; Drug known as Speed. Historic link between production of speed and outlaw motorcycle gangs.
1970	Controlled Substances Act passed; Methamphetamine production regulated.
Late 1980s	Smokable forms of methamphetamine introduced. New epidemic started in Japan and Korea, then spreads to Hawaii and the western U.S.
1990s	Used in 1991 Operation Desert Storm, allegedly to increase wakefulness and attention. Methamphetamine epidemic spreads eastward; heavy use and production in California, Arizona, Utah and western region.
Present day	Methamphetamine is the most widely used dangerous drug in the United States.

In Canada, methamphetamine is classified as a Schedule III drug under the Controlled Drugs and Substances Act. It is not approved for any medical use. The United States has classified methamphetamine as a Schedule II stimulant with approval for treatment of attention deficit disorder and exogenous obesity. It is used off-label for the treatment of narcolepsy (Hoecker, n.d.). In both the United States and Canada, enforcement tries to control the illicit manufacturing and distribution.

Although methamphetamine may not be the most frequently used illicit drug among emergency patients across the country, the numbers are increasing. An article in The Calgary Herald (October 26, 2004) claims crystal methamphetamine is emerging as the most prominent drug in Alberta, with law enforcement agencies and organizations that treat addicts reporting increased signs of its use and production. There are geographical patterns of illicit drug use. Health care providers need to stay current with drug use patterns in their locale.

History and pharmacology

The prototype of methamphetamine is the drug amphetamine which was first synthesized in 1887 and is structurally related to the natural occurring stimulant ephedrine (Walton, 2001). Table One outlines a brief history of methamphetamine use and abuse.

Methamphetamine is a very powerful and highly addictive central nervous system stimulant. Once the synthesis from ephedrine to final product is accomplished, the result is an extremely dangerous hallucinogenic amphetamine. Use of methamphetamine results in an accumulation of the neurotransmitter dopamine. This excessive dopamine concentration appears to produce the stimulation and feelings of euphoria into areas of the brain that regulate pleasure (National Institute on Drug Abuse, n.d.). Prolonged stimulant effects are due to the longer duration of action and larger percentage of the drug that remains unchanged in the body.

This drug can be seen in many forms including pills, gel caps, chunks and powder. It can look like small pieces of glass with a colour range from clear to white, yellow, brown, green and

Table Two: Key facts about crystal methamphetamine

(Walton, 2001, National Institute on Drug Abuse, n.d., Derlet & Albertson, n.d., Wolkoff, n.d.)

Classification of drug	Central nervous system stimulant
Common street names (varies according to geographic location)	Ice; glass; crystal; jib; batu; shabu
Physiological responses	Tachycardia; tachypnea; hypertension; hyperthermia; euphoria; hallucinations leading to confusion; anxiety; aggression; diaphoresis; sleeplessness; anorexia
Eye characteristics	Constricted or dilated; extremely rapid eye movement
Onset of action	Rapid, within seconds
Duration of action	Half-life ranges from 10 to 20 hours, depending on the urine pH (half-life is shorter in acidic urine), history of recent use, and dosage. A difficult 'crash' can be experienced with significant fatigue and depression, which can last a few days to a week (longer with chronic or heavy users).
Effects of use	The euphoria experienced is similar to base cocaine. However, the effects last much longer
Methods of use	ICE is normally smoked in a pipe. However, it can be ground into a powder and injected or inhaled. Leaves a residue that can be resmoked.
Negative effects of use/safety	Extreme paranoia; strong violent tendencies
Issues for medical personnel	Withdrawal causes severe depression; users can engage in binge type behaviour and go without sleep or food for days
Possibility of physical addiction	Extremely addictive
Physical characteristics of substance	ICE appears as clear, shiny crystals, varying in size from rice grains to the size of the distal metacarpal of your fifth digit
Odours associated with substance	Chemical smell when burned
Drug paraphernalia	Broken light bulbs which are used as pipes
Dosage	ICE is measured in tenths of grams; each tenth of one gram = three to four 'hits'
Associated drugs	Base cocaine; studies show that eight to 20% of street-available stimulants contain both drugs

pink. The routes of administration are diverse; they include oral ingestion, nasal inhalation and, due to the drug's solubility in water, intravenous injection. This drug is commonly smoked and, in this form, the vernacular of the street refers to the drug as crystal methamphetamine. Table Two outlines some key facts about crystal methamphetamine, which has been converted from its original form by a simple chemical process. The popularity of smoked methamphetamine is largely due to the immediate euphoria that results from the rapid absorption in the lungs and deposition in the brain, without the risks inherent with intravenous access. An analogy that can be drawn would be to say that Ice is to Methamphetamine what Crack is to Cocaine (Walton, 2001). Ice is viewed as very dangerous because of its purity and rapid addiction (Sullivan, 1995).

Emergency treatment after acute intoxication

Patients who are under the influence of methamphetamines will present with a variety of symptoms dependent on the dose, time elapsed, and history of previous usage (Derlet & Albertson, n.d.). Table Three outlines the general approach to the methamphetamine-intoxicated patient. Consultation with a clinical toxicologist through a regional Poison Centre is recommended for critically ill patients.

The safety of the emergency care team cannot be overemphasized. Users can present in a state of paranoia with violent behaviour and require both physical and chemical restraints. Security personnel are often required to help protect the patient and staff from harm.

Emergency care focuses on those presenting symptoms as well as trying to minimize damaging complications to major organs. Clinical toxicity of methamphetamine primarily affects the cardiovascular and central nervous systems (CNS); if the drug is inhaled or smoked, pulmonary symptoms may occur (Derlet & Albertson, n.d.). The more common patient presentations will be discussed.

Central nervous system

- Agitation and anxiety: Benzodiazepines are most commonly given to manage agitation; large doses may be required (Bebarta, 2003).
- Hallucinations: There are no antidotes for hallucinations. In addition to benzodiazepines to reduce agitation, haloperidol may be the most appropriate medication for patients

experiencing primarily the mind-altering effects of the methamphetamine (Bebarta, 2003). A calm environment (difficult in a busy ED), reassurance and avoidance of injury are also indicated.

- Psychosis: Methamphetamine can induce an acute toxic psychosis in previously healthy persons and precipitate a psychotic episode in those with psychiatric illness (Derlet & Albertson, n.d.). Antipsychotics such as haloperidol are indicated. Again, large doses may be required.
- Seizures: Methamphetamine-induced seizures have been viewed as isolated events, or associated with hyperthermia, coma, metabolic acidosis, secondary rhabdomyolysis, renal failure and shock (Derlet & Albertson, n.d.). Treatment includes airway management, benzodiazepines, supportive care and further investigations for the cause of the seizures.
- Unresponsiveness: Some patients who have used methamphetamine present unconscious to the emergency department. Decreased level of consciousness may be caused by the concurrent use of other drugs such as opioids and alcohol, from the direct effects of intravenous methamphetamine, or secondary to amphetamine-induced seizures (Derlet & Albertson, n.d.). Treatment includes the basics of oxygenation and ventilation, seizure precautions and monitoring of blood glucose. If the patient presents with both CNS and respiratory depression, an opioid antagonist such as naloxone may be given. It is sensible to titrate the dose of naloxone to reverse respiratory and CNS depression without precipitating withdrawal (Bebarta, 2003).

Other potential serious CNS disorders induced by amphetamines include CVAs caused by hemorrhage or vasospasm, cerebral edema and cerebral vasculitis (Derlet & Albertson, n.d.).

Cardiovascular

- Tachycardia: The direct stimulant effect of methamphetamine may cause tachycardia, or it may be a compensatory mechanism for overall dehydration. Users at parties can dance for hours without stopping. Intravenous crystalloids will replenish the depleted circulatory volume.
- Atrial and ventricular arrhythmias: Advanced cardiac life support (ACLS) protocols should be followed for the treatment of symptomatic cardiac arrhythmias. Beta

Table Three: General emergency care of the methamphetamine-intoxicated patient

(Hoecker, n.d.)

Airway management; supplemental oxygen; cardiac monitoring; 12-lead EKG; intravenous fluids; core body temperature monitoring; laboratory blood tests

(CBC, serum electrolytes, glucose, creatinine, coagulation studies, fibrinogen liver function tests, arterial blood gas)

Urine drug screen
Activated charcoal (oral ingestions)

blockers, such as propranolol, should be avoided, because they may potentiate coronary artery vasoconstriction (Hantsch & Seger, 2003).

- Chest pain, myocardial ischemia: Chest pain following methamphetamine use may result in myocardial ischemia. Patients are at risk for ischemia because of accelerated atherosclerosis from chronic drug use and other less well-understood mechanisms (Derlet & Albertson, n.d.). Concurrent use of ethanol will potentiate the cardiac effects. Nitroglycerin, analgesics and other cardiac interventions may be used (Hantsch & Seger, 2003).
- Hypertension: Elevated blood pressure from stimulant toxicity is usually short-lived (Hantsch & Seger, 2003). A

hypertensive crisis may be treated with alpha antagonists such as phentolamine, or alpha/beta antagonists such as labetalol (Hoecker, n.d.). Vasodilators such as nifedipine or nitroprusside may also be used (Hoecker, n.d.).

Respiratory

- Dyspnea and wheezing: Supplemental oxygen and nebulized bronchodilators are used to alleviate these symptoms.
- Drug-induced hyperthermia syndrome: Users at a crowded, hot dance party are at increased risk of dehydration and heat exhaustion. The diuretic effect of concurrent alcohol use will contribute to the degree of dehydration. More serious, drug-induced hyperthermia is a life-threatening complication that

Table Four: Abuse cycle of high-intensity and binge abusers of methamphetamine

(Walton, 2001)

Stage	Duration	Comments	Specific Safety Issues
First Stage: RUSH	Five to 30 minutes	Body metabolism increases Feelings of pleasure	
Second Stage: HIGH	Four to 16 hours	Abuser feels aggressively smarter and may become argumentative	
Third Stage: BINGE	Three- to 15-day high where each ingestion of drug results in a diminishing RUSH until there is no rush or high	Abuser becomes mentally and physically hyperactive in attempting to maintain HIGH as long as possible	
Fourth Stage: TWEAKING	A Tweaker has likely been three to 15 days without sleep	Nothing the abuser does can take away the emptiness the binge has created Some "Tweakers" take depressants such as alcohol or heroin to ease feelings of emptiness	Most dangerous stage of cycle Hallucinations are vivid; do not need provocation to react violently Six steps in dealing with a Tweaker: • Keep your distance • Lower the lights • Slow your speech; lower your voice • Slow your movements • Keep your hands visible • Keep the Tweaker talking
Fifth Stage: CRASH	Abuser sleeps from one to three days revitalizing their body		
Sixth Stage: NORMAL	Two to 14 days	Abuser returns to a normal state which is slightly deteriorated from that prior to BINGE stage. As the frequency of the binge increases, the duration and degree of 'normal' decreases	
Seventh Stage: WITHDRAWAL	Varying length of time	Abusers realize they are withdrawing from effects of drug, many become depressed and suicidal. Only 10 to 20% of abusers who seek treatment for dependence actually succeed in defeating this cycle of abuse.	

requires rapid recognition. Active cooling measures, similar to treatment of heat stroke, are indicated. These include iced intravenous fluids and cool water bladder washes (Hoecker, n.d.).

Concurrent injuries

Methamphetamine users tend to engage in high-risk activities. The drug is a GABA agonist and inhibits access to certain parts of the brain, especially the frontal lobe where 'executive functions' are contained. There is a generic tendency to incorporate poor judgment and make bad decisions when actively high on this drug. As a result, users can incur injuries from altercations and motor vehicle crashes due to aggressive and erratic driving. Sexual assaults may occur with either the perpetrator and/or victim high on this drug. Methamphetamine toxicity will complicate the management of a trauma patient.

High intensity and binge abusers

Methamphetamine is often used in a 'binge and crash' pattern. Tolerance for the drug occurs within minutes; the pleasurable effects disappear even before the drug concentration in the blood decreases significantly (National Institute on Drug Abuse, n.d.). Users try to maintain their high by bingeing on the drug. High intensity and binge abusers can then enter into an abuse cycle, which takes weeks to complete. Table Four describes each of the seven stages. Abusers are most likely to present to the emergency department during the second, third, fourth and seventh stages of this cycle. Rehabilitation for methamphetamine addiction can be a huge challenge; the failure rate of detoxification programs is up to 90% (Walton, 2001).

Other related emergency situations

It is obvious that methamphetamine is detrimental to the health of the user. In a broader sense, the drug can impact people other than the actual consumers. By virtue of their profession or occupation, innocent individuals can be forced to deal with methamphetamine users and, as a result, could be placed in harm's way when dealing with an irrational, violent drug consumer.

Another major safety consideration revolves around the clandestine production of the drug. 'Meth labs' have been discovered in neighbourhoods in every level of society and production facilities have been located in a diverse range of facilities. The labs can be small enough to fit in a suitcase, or large enough to fill a commercial warehouse (Alberta Fire Protection Commissioner, 2003). The varying combinations of chemicals may produce fire and explosion risks, toxic gases, and chemical spills (Hantsch & Seger, 2003). Common household items used in methamphetamine production, such as farm fertilizer, brake cleaner and drain cleaner will contribute to the chemical hazard (Slobodian, 2004). For every pound of methamphetamine produced, six pounds of hazardous toxic waste are left behind (Slobodian, 2004). EDs may care for fire department, law enforcement, emergency medical personnel, innocent bystanders or those involved with the illicit manufacturing of methamphetamine. Occupants of 'meth lab'

homes, especially children, may require testing and treatment for exposure to the powder that is so prevalent in these environments. Children can also suffer from physical abuse and profound neglect when their caregivers are 'strung out'.

The last decade has seen an increase in the use and production of the drug that was formerly better known as speed. While law enforcement agencies continue to dedicate resources designed to cause dysfunction in production and distribution networks, health care systems continue to feel the negative ramifications of the use of this volatile substance. ❏

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