



Wenlong Li
Naren Gunja

Illicit drug overdose

Prevalence and acute management

Background

Illicit drug use is common in Australia, with nearly 40% of Australians having tried an illicit substance in their lifetime. While cannabis is by far the most prevalent substance used, heroin and other opiates contribute to over 90% of deaths associated with illicit drug use.

Objective

This article describes the current epidemiology and harms related to illicit drug use, and outlines the principles in the management of acute overdose.

Discussion

The acute management of a suspected overdose involves the identification of the toxicants by taking a careful history accompanied by a focused physical examination. An understanding of the pharmacological profile of the illicit drug and its corresponding toxidrome is essential in providing acute care before referral to emergency medical services.

Keywords

drug overdose; emergencies

diagnosis and subsequent management of illicit substance use.

Epidemiology of use and harm

A 2010 survey showed that nearly 40% of Australians over 14 years of age had used an illicit substance in their lifetime, and 15% had used within the past 12 months.³ Of these, cannabis use was most widespread, with a prevalence of 10.3%, followed by 3,4-methylenedioxymethamphetamine (MDMA or ecstasy; 3.0%) and methamphetamine and cocaine (2.1%). The prevalence of heroin use was less than 1.0%.^{2,3} This study underlines the fact that there has not been any significant reduction in the prevalence of illicit drug use within the past decade.² In fact, cannabis use has increased (9.1% in 2007 to 10.3% in 2010), while a reduction in MDMA use (3.5% in 2007 to 3.0% in 2010) may be due to reduced supply.

For all the drugs mentioned above, use is most prevalent among young adults aged 20–29 years.⁴ This broadly correlates with drug overdose associated harm, as hospitalisation rates are highest in the 20–29 years age group; although for cocaine, cannabis and heroin, rates are also high in the 30–39 years age group.⁵ A likely explanation is that these older users are often more entrenched in drug use.² Gender differences are apparent. Males are more likely to have tried illicit drugs across all age groups, and have a higher rate of hospitalisation.^{4,5}

Heroin and related opiates are responsible for the highest mortality rate, despite their relatively low prevalence.² The majority of deaths were due to overdose, followed by associated diseases (eg. HIV infection, viral hepatitis) and suicide.⁶

Amphetamines have the second highest mortality rate of the illicit substances. Acute harm from amphetamine overdose is associated with delirium, psychosis and cardiovascular

The societal burden from illicit drug use was estimated to exceed \$8 billion in the 2004–05 financial year, of which the net cost to the Australian healthcare system was \$201.7 million.¹ The spectrum of acute medicine attributable to illicit drug abuse comprises drug overdose, drug induced psychosis, withdrawal and other medical complications. While mortality has declined with drug prevention strategies, overdose due to illicit drugs has nevertheless caused over 400 deaths annually.²

This article seeks to review the current trends in illicit drug overdose in Australia, and outline the recommended management strategies for acute poisoning. While the majority of acute poisoning is treated in the hospital setting, general practitioners play an important role in the

side effects. An increasing trend of intravenous amphetamine use has added the possible complication of blood borne virus transmission. There were 26 deaths attributable to amphetamines in Australia in 2005.² The extent of harm from MDMA has not been fully elucidated, however a National Coronial Information System review identified a total of 82 MDMA related deaths between 2000 and 2005, of which, 67 were directly attributed to the drug.⁷ Cocaine accounted for around 10 deaths in 2005, with mechanism of harm similar to that caused by amphetamines.^{4,8} There is yet to be a report of death directly caused by cannabis overdose,⁴ although it accounts for the third highest illicit drug related hospitalisation rate after heroin and amphetamines.⁵

Approach to acute drug overdose

The current management of illicit drug overdose primarily involves meticulous supportive care in a hospital environment. Victims of drug overdose may self-present to hospital or be brought to the emergency department by ambulance. In the primary care setting, the application of first aid and resuscitation can be life saving for the intoxicated patient. The Australian Poisons Information Centres can provide up-to-date advice on the management of illicit substance poisoning (see *Resources*).

Establishing a risk assessment alongside resuscitation are the first management priorities. This involves careful history taking and focused examination (*Table 1*). There is a significant disconnect in drug terminology between illicit substance users and health practitioners. *Table 2* contains common street names for illicit substances that may aid in conversing with patients.⁹ The clinician should keep in mind that it is common for the patient to have ingested multiple toxicants. Therefore, it is important to ascertain a full history, including details of licit substance use such as alcohol, tobacco, caffeine, prescription medications, over-the-counter and herbal preparations, as well as illicit substances. Comorbidities should be determined, as illicit drug use is associated with conditions such as mental illness, liver and chronic infectious disease. A history of psychiatric disorder or suicidal ideation will prompt subsequent mental health

referral. Pre-existing cardiovascular conditions may be important when managing complications from cocaine and amphetamine abuse.

Illicit drug overdose commonly presents as one of several clinical toxidromes (*Table 3*). The sedated or unconscious patient may be affected by central nervous system (CNS) depressants such as opiates, γ -hydroxybutyrate (GHB) or benzodiazepines. Care of these patients will involve providing airway support and ensuring adequate oxygenation and ventilation. The hyper-stimulated patient suggests toxicity from amphetamines, cocaine or newer

synthetic stimulants, such as cathinones. Here, sedation and assessment of neurological and cardiovascular risk are the priorities of management. A third common presentation is an acute psychotic episode that may be precipitated from exposure to cannabinoids or stimulants. Severely agitated patients pose a significant risk not only to themselves, but also staff and other patients. They may require five-point physical restraint and chemical sedation. Common sedative regimens include a combination of a short acting benzodiazepine (eg. midazolam), and an anti-psychotic (eg. droperidol or olanzapine).¹⁰

Table 1. Initial assessment of suspected drug overdose

History	<ul style="list-style-type: none"> • Age, gender • History of drug exposure <ul style="list-style-type: none"> – drug(s) – dose – route – timing – type (eg. deliberate self poisoning, recreational, accidental) • Other drug history <ul style="list-style-type: none"> – alcohol – tobacco – caffeine
Examination	<ul style="list-style-type: none"> • General overview: vital signs (heart rate, blood pressure, temperature, respiratory rate, oxygen saturation) • Observation: colour, track marks, smell, bruising, skin changes, pressure sores • Neurological: Glasgow Coma Scale, pupils, tone, limb movements, reflexes, clonus, fasciculations • Other: signs of aspiration, secretions, signs of injury or trauma
Investigations	<ul style="list-style-type: none"> • Blood glucose level • Electrocardiogram • Blood gas • β-HCG (in women of childbearing age) • Screening paracetamol level (in deliberate self poisoning)

Table 2. Street names of common illicit drugs

Drug name	Street names
Amphetamines (eg. methamphetamine, PMA)	Speed, meth, ice, uppers, death (PMA)
Cannabis	Marijuana, weed, pot, grass, joint, mull, cone, dope, ganja, hash, chronic
Cocaine	Snow, crack, coke, rock
Ecstasy (MDMA)	XTC, E, Eccies, M&Ms, Adam
Heroin	Smack, horse, junk, skag, brown, Harry, 'H'
γ -hydroxybutyrate	GHB, fantasy, date rape drug, grievous bodily harm, liquid X/E/G

Table 3. Toxidromes, complications and treatment options in common illicit drug poisoning

Illicit drug(s)	Associated toxidrome	Complications	Treatment options
Amphetamines Cocaine MDMA	Sympathomimetic toxidrome <ul style="list-style-type: none"> • CNS excitation: euphoria, hallucinations, agitation, psychosis, delirium, seizures • Neuromuscular excitation: hyper-reflexia, tremor • Autonomic effects: hyperthermia, diaphoresis, flushing, mydriasis • Cardiovascular effects: tachycardia, hypertension, myocardial depression, arrhythmias • Gastrointestinal effects: nausea, vomiting, diarrhoea • MDMA can precipitate serotonergic toxidrome 	<ul style="list-style-type: none"> • Seizures • Hypertension • Acute coronary syndrome • Rhabdomyolysis • Shock/cardiovascular collapse • Arrhythmias • Hyponatraemia (MDMA) • Hyperthermia (>39°C) • Serotonin toxicity 	<ul style="list-style-type: none"> • Acute coronary syndrome: aspirin, nitrates, opiate analgesia, benzodiazepines • Agitation: benzodiazepines, droperidol • Seizures, hypertension: benzodiazepines • Arrhythmias: sodium bicarbonate, amiodarone • Hypotension/shock: crystalloid infusion, inotropes • Hyperthermia: IV fluids, ice packs. May need intubation and paralysis
Opiates	Opiate toxidrome <ul style="list-style-type: none"> • CNS depression: drowsiness to coma • Respiratory depression, hypercapnia 	<ul style="list-style-type: none"> • Respiratory failure • Aspiration (pneumonitis) • Non-cardiogenic pulmonary oedema • Rhabdomyolysis • Hypothermia 	<ul style="list-style-type: none"> • Oxygen plus respiratory support for acute management • Naloxone IV boluses (100–400 µg), titrated to clinical effect • If long acting opiate, may need naloxone IV infusion • Supportive care: <ul style="list-style-type: none"> – IV rehydration – re-warming in hypothermia – maintenance of euglycaemia
Cannabis	Psychological disturbance <ul style="list-style-type: none"> • Depersonalisation, disorientation, decreased inhibition, altered mood, memory impairment, lack of attention 	<ul style="list-style-type: none"> • Agitation • Psychosis • Hyperemesis 	<ul style="list-style-type: none"> • Reassurance • Anti-emetics • Titrated oral or IV benzodiazepines • Anti-psychotics

Heroin and other opiates

The presentation of opiate overdose includes CNS depression and hypoventilation. The presence of a low respiratory rate (<10 breaths per minute) in a semi-awake state is highly suggestive of opiate poisoning, particularly when accompanied with miosis.¹¹ In addition, the patient may present with the common complications of aspiration pneumonitis or non-cardiogenic pulmonary oedema. Additional investigations should include end-tidal CO₂ monitoring or blood gas analysis, as pCO₂ is the best measure of hypoventilation. Consideration of chest X-ray to assess pulmonary oedema is useful, as auscultative signs are likely to be diminished in patients with bradypnoea.¹¹

The patient may develop severe hypoventilation, despite being in a rousable state (ie. Glasgow Coma Scale >12). Thus, providing airway and ventilatory support takes priority in all patients suspected of opiate poisoning.

After appropriate pre-hospital care, all patients suspected of heroin overdose should be admitted to the emergency department. Naloxone, an opiate antagonist, is indicated in opiate overdose and should be titrated to respiratory rate and effort, rather than the level of consciousness. Naloxone may be administered through various routes, including intramuscular (IM), intranasal (IN) and intravenous (IV). Doses in adults range from 100–400 µg IV,^{12,13} and 2 mg IM or IN. The IN route has several advantages

in the pre-hospital setting, including a simpler rapid delivery system that carries less needlestick risk.¹⁴ Careful and timely administration of naloxone is recommended, as it may precipitate acute opiate withdrawal in opiate dependent patients. Withdrawal is characterised by agitation, diaphoresis and tachycardia. Naloxone administration may also give patients the ability to abscond from a healthcare setting, increasing the risk of accidental injury or recurrent sedation.

The current wave of prescription opiate abuse involves primarily oxycodone, codeine, morphine, tramadol and methadone. The presentation and management of poisoning with these opiates is similar to that for heroin, although the patient demographic is variable.

Amphetamines and cocaine

The presentation of amphetamine and cocaine overdose is consistent with sympathomimetic excess characterised by cardiovascular and autonomic hyperstimulation, as well as neuropsychiatric disturbance, such as delirium, hallucinations and agitation. The electrocardiogram is crucial in the assessment of acute coronary syndromes and arrhythmias in these patients.

Acute myocardial infarction is a serious complication of amphetamine and cocaine poisoning, and chronic sympathomimetic drug use is a strong risk factor for early onset coronary syndromes in teenagers and young adults.¹⁵ Coronary angiography often fails to reveal focal stenosis in these patients, as infarction is usually due to coronary vasospasm.

In the community, acute coronary syndrome thought to be from stimulant use should be managed with opiate analgesia, benzodiazepines, nitrates and aspirin. Benzodiazepines are an important component of treating the common cardiac features of sympathomimetic overdose, as well as delirium and agitation. They may be given orally in mild cases, however IV administration may be required for severe toxicity. Benzodiazepines are also first line in the management of stimulant-induced seizures and hypertension.

Symptomatic patients should be admitted to hospital for monitoring and treatment; delirium may persist for 48 hours.

Patients with cocaine overdose may also present with wide-complex tachyarrhythmias, such as ventricular tachycardia.¹⁶ Evidence suggests this is due to potent blockade of cardiac sodium channels. Treatment of cocaine induced ventricular tachycardia involves serum alkalinisation with hyperosmolar boluses of sodium bicarbonate 1–2 mmol/kg IV.¹⁶

Ecstasy

Methylenedioxymethamphetamine is a potent amphetamine derivative with serotonergic activity. The effect of MDMA differs to amphetamine, as it enhances empathy, intimacy, loquacity and positive mood.¹⁷ Presentation of acute poisoning ranges from bruxism, palpitations, hypertension and diaphoresis in mild cases, to an amphetamine-like sympathomimetic toxidrome in severe poisoning.^{7,17} Interactions with other

serotonergic substances may cause clinically significant serotonin toxicity.¹⁸

MDMA toxicity may present with hyperthermia, either due to its inherent toxicological effect, or due to the environment in which it is taken (eg. at 'rave' parties where vigorous dancing may lead to dehydration).^{7,19} In addition, patients may present with hyponatraemia associated with increased vasopressin release, leading to delirium and convulsions.²⁰ The treatment of MDMA overdose is similar to that described for amphetamine overdose. Hyponatraemia and hyperthermia, when severe, should be managed aggressively with hypertonic saline and cooling.

Cannabis

Common clinical features of acute cannabis intoxication are anxiety and panic, which are often reported in cannabis-naive patients.²¹ The patient may also exhibit feelings of depersonalisation, disorientation, decreased inhibition, altered mood, memory impairment, and difficulty in maintaining attention. Tachycardia, palpitations, paroxysmal atrial fibrillation and orthostatic hypotension are also reported.^{21,22} Although cannabis use is associated with psychotic disorders, acute cannabis toxicity is rarely serious, and symptoms usually resolve within 2–3 hours after inhalation and 4–12 hours after oral ingestion.²³ Patients with cannabis toxicity often only require reassurance, though benzodiazepines may be helpful in the management of agitation.

Other illicit drugs

There is an array of other illicit substances the clinician may encounter. γ -hydroxybutyrate is a clear tasteless liquid and induces rapid onset CNS depression; its short duration of action and rapid offset mean that intervention is rarely warranted.²⁴ In the intoxicated patient, the clinical picture may resemble that of benzodiazepine overdose, and management is similarly supportive. There is also a group of emerging 'designer' psychoactive substances, including cathinones and cannabinoids. These synthetic drugs resemble amphetamines and cannabis respectively, and the principles for their management are similar to that for a hyperstimulated patient. However, it should be noted that concomitant use of multiple substances would alter the individual presentation and clinical findings.

Summary

There has been little change in the prevalence of illicit drug use in the past decade, leading to a continued burden on the healthcare system in Australia. In the primary care setting, effective management of acute illicit drug poisoning requires accurate assessment of the patient, as well as appropriate supportive care. The provision of first aid and resuscitation can be life saving while awaiting transport to a hospital environment where advanced support is available.

Resources

- Australian Poisons Information Centres
24 hour information line providing advice to the public and health professionals on overdose
13 11 26
- Alcohol and Drug Information Service (ADIS):
24 hour information line for the public and health professionals. Visit the National Drugs Campaign www.drugs.health.gov.au for contact information in each state or territory.

Authors

Wenlong Li BPharm(Hons), is a pharmacist and medical student, Sydney Medical School, University of Sydney, New South Wales. weli3785@uni.sydney.edu.au

Naren Gunja MBBS, MSc, FACEM, FACMT, is Medical Director and toxicologist, NSW Poisons Information Centre, The Children's Hospital at Westmead and Clinical Associate Professor, Discipline of Emergency Medicine, Sydney Medical School, New South Wales.

Competing interests: None.

Provenance and peer review: Not commissioned; externally peer reviewed.

References

1. Collins DJ, Lapsley HM. The costs of tobacco, alcohol and illicit drug abuse to Australian society in 2004/05. Commonwealth of Australia, 2008. Available at www.nationaldrugstrategy.gov.au/inter-net/drugstrategy/publishing.nsf/Content/mono66 [Accessed 15 December 2012].
2. Roxburgh A, Ritter A, Grech K, Slade T, Burns L. Trends in drug use and related harms in Australia 2001 to 2011. Sydney: Drug Policy Modelling Program, National Drug and Alcohol Research Centre, University of New South Wales, 2011.
3. Australian Institute of Health and Welfare. Drugs in Australia 2010: tobacco, alcohol and other drugs. Canberra: Australian Institute of Health and Welfare, 2011.
4. Ross J. Illicit drug use in Australia: epidemiology use patterns and associated harm. 2nd edn. Sydney: National Drug & Alcohol Research Centre, 2007.
5. Roxburgh A, Degehard L. Hospital stays related to

- illicit drugs in Australia 1993–2004. NDARC Technical Report Number 261. Sydney: National Drugs and Alcohol Research Center, University of New South Wales, 2006.
6. Darke S, Mills KL, Ross J, Teesson M. Rates and correlates of mortality amongst heroin users: findings from the Australian Treatment Outcome Study (ATOS), 2001–2009. *Drug Alcohol Depend* 2011;115:190–5.
 7. Kaye S, Darke S, Dufflou J. Methylenedioxymethamphetamine (MDMA)-related fatalities in Australia: demographics, circumstances, toxicology and major organ pathology. *Drug Alcohol Depend* 2009;104:254–61.
 8. Roxburgh A, Burns L. Drug-induced deaths in Australia 2007 edition. Sydney: National Drug and Alcohol Research Centre, University of New South Wales, 2011.
 9. Hamid H, El-Mallakh RS, Vandevair K. Substance abuse: medical and slang terminology. *South Med J* 2005;98:350–62.
 10. Chan EW, Taylor DM, Knott JC, Phillips GA, Castle DJ, Kong DC. Intravenous droperidol or olanzapine as an adjunct to midazolam for the acutely agitated patient: a multicenter, randomized, double-blind, placebo-controlled clinical trial. *Ann Emerg Med* 2013;61:72–81.
 11. Boyer EW. Management of opioid analgesic overdose. *N Engl J Med* 2012;367:146–55.
 12. Australian Medicines Handbook 2013. Adelaide: Australian Medicines Handbook Pty Ltd, 2013.
 13. Therapeutic Guidelines Limited. Therapeutic Guidelines: Toxicology and wilderness. Version 2. Melbourne: Therapeutic Guidelines Limited, 2012.
 14. Kelly AM, Kerr D, Dietze P, Patrick I, Walker T, Koutsogiannis Z. Randomised trial of intranasal versus intramuscular naloxone in prehospital treatment for suspected opioid overdose. *Med J Aust* 2005;182:24–7.
 15. Vasica G, Tennant CC. Cocaine use and cardiovascular complications. *Med J Aust* 2002;177:260–2.
 16. Wood DM, Dargan PI, Hoffman RS. Management of cocaine-induced cardiac arrhythmias due to cardiac ion channel dysfunction. *Clin Toxicol (Phila)* 2009;47:14–23.
 17. Kalant H. The pharmacology and toxicology of “ecstasy” (MDMA) and related drugs. *CMAJ* 2001;165:917–28.
 18. Silins E, Copeland J, Dillon P. Qualitative review of serotonin syndrome, ecstasy (MDMA) and the use of other serotonergic substances: hierarchy of risk. *Aust N Z J Psychiatry* 2007;41:649–55.
 19. Dar KJ, McBrien ME. MDMA induced hyperthermia: report of a fatality and review of current therapy. *Intensive Care Med* 1996;22:995–6.
 20. Fallon JK, Shah D, Kicman AT, et al. Action of MDMA (ecstasy) and its metabolites on arginine vasopressin release. *Ann N Y Acad Sci* 2002;965:399–409.
 21. Ashton CH. Pharmacology and effects of cannabis: a brief review. *Br J Psychiatry* 2001;178:101–6.
 22. Hall W, Degenhardt L. Adverse health effects of non-medical cannabis use. *Lancet* 2009;374:1383–91.
 23. Grotenhermen F. Pharmacokinetics and pharmacodynamics of cannabinoids. *Clin Pharmacokinet* 2003;42:327–60.
 24. Dutch MJ, Austin KB. Hospital in the field: prehospital management of GHB intoxication by medical assistance teams. *Prehosp Disaster Med* 2012;27:463–7.