

STIMULANTS AND MYOCARDIAL ISCHAEMIA: A CASE SERIES AND LITERATURE REVIEW.

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Introduction: Over the past ten years the use of illicit stimulants including amphetamine and its derivatives has increased in the Australian population.(1) This has been associated with an increase in emergency department presentations related to the use of these drugs.(2) We report a series of four patients who presented to our tertiary hospital with chest pain due to myocardial ischaemia after taking illicit stimulants (amphetamines or cocaine). Early recognition of this condition will lower the incidence of mortality and subsequent left ventricular dysfunction associated with this condition.

The cases: All patients in our series had a typical rise and fall in serum levels of troponin I.
Patient One: A 26 year old women who presented one and a half hours after injecting 'speed' (amphetamine). She described headache, palpitations and chest pain. The ambulance recorded ventricular bigeminy and hypertension (180/100) which resolved prior to presentation at hospital. She had transient ST depression on electrocardiogram (ECG). She received aspirin. A transthoracic echocardiogram (TTE) showed overall normal left ventricular systolic function with an akinetic basal anteroseptum. She had angiographically normal coronary arteries and anterior wall hypokinesis. Patient Two: An 18 year old man with a family history of ischaemic heart disease who presented thirty-six hours after consuming alcohol, 'NoDoz' (caffeine) tablets and 'speed' (amphetamine). He described twenty-four hours of central chest pain. His ECG showed inferolateral ST elevation. He received aspirin, unfractionated heparin, morphine and intravenous glyceryltrinitrate (GTN). Urgent left heart catheterization was performed and showed vasospasm of the left coronary system which improved after intracoronary GTN. Left ventriculogram showed anterior wall and apical hypokinesis. TTE confirmed overall normal left ventricular systolic function with apical hypokinesis. The ECG changes resolved over thirty-six hours during which time he remained on a GTN infusion and was commenced on a calcium channel blocker. Repeat TTE at six weeks showed incomplete improvement in the regional wall motion abnormality. Patient Three: A 24 year old man who presented with 24 hours of central heavy chest pain three days after 'snorting' one 'line' of cocaine. ECG showed anterolateral ST elevation. He received aspirin, heparin and morphine. After commencement of a GTN infusion his symptoms and ECG changes resolved. TTE was unremarkable. Patient Four: A 30 year old man who regularly used cocaine who presented two hours after 'snorting' one line of cocaine. He described palpitations which resolved prior to reaching hospital but persisting central chest pain. Initially he was hypertensive with a blood pressure of 200/100. He had no significant ECG changes. He received aspirin, heparin, morphine and sublingual GTN. His pain resolved. Diagnostic left heart catheterization demonstrated angiographically normal coronary arteries. TTE was within normal limits.

Discussion questions:

Why is this an important issue in our community ?
What is the mechanism by which stimulants cause myocardial ischaemia ?
How will stimulant users present to our health services ?
How should stimulant related ischaemia be managed and what is the evidence for this ?

Literature review: Gray et al (2007) audited the amphetamine related presentations to a tertiary emergency department in Perth, Australia. Over 3 months, 1.2% of 13,125 presentations were related to amphetamines. 50% of these had an ECG. 4.5% presented with chest pain and 3.2% with palpitations. A 36 year old man was admitted with a diagnosis of coronary artery spasm.(2)

Turnipseed et al (2003) audited patients presenting to an emergency department in Sacramento, United States, with chest pain after taking methylamphetamine. Over 2 years 171 patients

presented with chest pain and methylamphetamine use diagnosed on urine drug screen. 25% were diagnosed with an acute coronary syndrome (positive cardiac enzymes within 12 hours). 8% had life threatening cardiac complications (myocardial infarction and ventricular tachycardia). 4 patients underwent coronary angiography (at the treating physicians discretion), 3 had coronary artery stenosis and 1 had normal coronary arteries. The frequency of abnormal ECGs did not differ significantly between those with and without acute coronary syndrome.(3)

Amphetamines and other designer drugs including methylenedioxymethamphetamine (MDMA) or ecstasy as well as cocaine are all classified as stimulants. All have similar effects on the cardiovascular system predominantly related to activation of the sympathetic nervous system.(4) They can be injected, 'snorted' (intranasal) or taken orally. They are readily absorbed through the mucous membranes and freely cross the blood-brain barrier. Amphetamine half lives vary between 5 and 30 hours. Cocaine has a short half life between 30 and 80 minutes. Cocaine and amphetamines as well as their metabolites are excreted in the urine for up to two weeks.

Cardiovascular presentations are varied including anxiety, nausea, chest pain, palpitations, shortness of breath, hypertension even sudden death. These can be caused by myocardial ischaemia, arrhythmias, cardiomyopathy, pulmonary oedema, pulmonary hypertension and even circulatory collapse.

Proposed mechanisms for these presentations include coronary artery vasospasm, platelet aggregation, rupture of atherosclerotic plaque due to increased sheer stress, increased myocardial oxygen demand, direct myocardial toxicity, coronary artery rupture or vasculitis of medium and small arteries. Cocaine is known to reduce levels of anticoagulant factors and activate platelets. Chronic use of stimulants has been associated with myocardial hypertrophy.

Diagnosis of stimulant use can be made using a urine drug screen, serum drug levels, or a saliva test. There are no randomized controlled trials comparing treatment strategies for stimulant associated coronary ischaemia. The American Heart Association/American College of Cardiology (AHA/ACC) has recommendations for the treatment of cocaine intoxication which are often extrapolated for the treatment of amphetamine intoxication. Specific therapies include benzodiazepines for agitation and seizures. Hypertension should be treated with vasodilators (nitroprusside or nifedipine) or alpha blockers. Coronary ischaemia should be treated with aspirin and heparin as well as nitrates and alpha blockers or calcium channel blockers. Beta blockers, alone, should be avoided as coronary vasospasm is predominantly mediated by alpha stimulation and thus beta blockers could exacerbate the vasospasm and precipitate hypertension. Persistent ST elevation should be managed with either thrombolysis (provided blood pressure is adequately controlled) or percutaneous coronary intervention. The overall mortality from acute coronary syndrome is generally low reflecting the age and general health of these patients but the frequency of life threatening complications is not negligible.

Cocaine related arrhythmias generally terminate spontaneously as the drug is metabolised, amphetamine related arrhythmias may be longer lasting. Haemodynamic compromise requires DC cardioversion. Adenosine is safe for stable supraventricular tachycardia. Alternatives include the use of an alpha blocker preceding beta blockade. Temporary pacing may be required for bradyarrhythmias. Lignocaine is safe for the treatment of sustained ventricular arrhythmias. There are no reports regarding the use of amiodarone or verapamil.(4)

Based upon the available literature we recommend a routine drug history in patients presenting with chest pain particularly younger patients, as well as drug screening tests, electrocardiography and cardiac enzyme evaluation. A normal ECG does not rule out acute coronary syndrome. Patients with established or suspected stimulant exposure warrant twelve to twenty-four hours of monitoring after the episode of chest pain. Established ischaemia should be managed according to current guidelines for conventional disease with additional attention to hypertension, coronary spasm and agitation. Rehabilitation and psychiatric assessment should be considered if and when deemed appropriate.

REFERENCES

1. Australian Institute of Health and Welfare. 2004 National Drug Strategy Household Survey: first results. Canberra: AIHW; 2005.
2. Gray SD, Fatovich DM, McCoubrie DL, Daly FF. Amphetamine-related presentations to an inner-city tertiary emergency department: a prospective evaluation. *Medical Journal of Australia*. 2007 Apr 2;186(7):336-9.
3. Turnipseed SD, Richards JR, Kirk JD, Diercks DB, Amsterdam EA. Frequency of acute coronary syndrome in patients presenting to the emergency department with chest pain after methamphetamine use. *Journal of Emergency Medicine*. 2003 May;24(4):369-73.
4. Ghuran A, Nolan J. Recreational drug misuse: issues for the cardiologist. *Heart*. 2000 Jun;83(6):627-33.
5. McCord J, et al. Management of cocaine associated chest pain and myocardial infarction. *Circulation*. 2008 April 8; 117.