The use of intravenous labetalol in the setting of rapid atrial fibrillation secondary to methamphetamine use

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Introduction
The use of beta-adrenoceptor antagonists for treatment of tachydysrhythmias secondary to sympathomimetic agents is controversial due to theoretical concerns of “unopposed alpha receptor stimulation,” a rare, inconsistent, and unpredictable phenomenon, which may result in worsening hypertension [1]. Labetalol is a dual alpha 1 and beta1/beta 2 adrenoceptor antagonist. We report the case of a 33-year-old male who developed rapid atrial fibrillation with a ventricular rate of 151 beats per minute in the setting of methamphetamine use. He received intravenous labetalol 10 mg on five occasions over a 6.5 h period, which slowed his ventricular rate and eventually resulted in restoration of sinus rhythm. Administration of labetalol did not produce a clinically significant rise in blood pressure. Combination alpha and beta blockade using labetalol may be an effective and safe treatment option in patients with methamphetamine associated supraventricular tachydysrhythmias.

Case details
A 33-year-old male was brought to the emergency department by ambulance with agitation. Past medical history was only notable for previous illicit substance use with multiple hospital presentations. He presented with a Glasgow Coma Score of 14 (E 4 V 4 M 6), heart rate 133 beats per minute (bpm), blood pressure 150/70 mmHg, temperature 33.3 degree Celsius (responding to a rewarming blanket), respiratory rate 16 and blood glucose of 9.1 mmol/L (164 mg/dl). He admitted to nasal insufflating (“snorting”) methamphetamine powder four hours prior to presentation and drinking an unknown amount of ethanol. He complained of palpitations and the feeling of anxiety, but he denied chest pain. Initial electrocardiogram (ECG) on arrival to hospital, four hours post-methamphetamine exposure, revealed atrial fibrillation (AF) with a rapid ventricular rate of 151 bpm (Figure 1). Serum electrolytes, magnesium and calcium concentrations were normal. At 6.5 h post exposure, he remained in AF but with a ventricular rate up to 180 bpm. In consultation with the Toxicology service, he received five 10 mg doses of intravenous labetalol at 8.5, 9.5, 12.5, 13.5, and 15 h post exposure. Ventricular rate slowed from a peak of 180 bpm to less than 120 bpm over the 6.5 h of labetalol bolus dosing, with no clinically significant increase in blood pressure (Figure 2). A normal sinus rhythm (heart rate of 90 bpm) was restored following the last bolus of labetalol. Post-reversion ECG did not reveal any underlying conduction abnormality. He remained asymptomatic and was discharged home. Serum methamphetamine concentration on presentation was 0.07 mg/L (based on high performance liquid chromatography/mass spectrometry analysis)
and the subsequent concentration 14.5 hrs post ingestion was 0.04 mg/L.

**Discussion**

Unopposed alpha receptor stimulation resulting from iatrogenic beta-adrenergic receptor blockade in patients with a hyperadrenergic state carries the theoretical risk of a rapid increase in blood pressure and/or worsening coronary artery vasoconstriction [2]. Unopposed agonism of vascular alpha-1 receptors may result in vasoconstriction. This potential concern has led to general recommendations to avoid the use beta-adrenergic receptor antagonists for treating hypertension or tachydysrhythmias in the setting of stimulant drug toxicity. In particular the use of non-selective beta antagonists, such as propranolol, might favour the development of unopposed alpha-1

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**Figure 1.** Twelve lead admission electrocardiogram of rapid atrial fibrillation taken at 4 h post ingestion.

**Figure 2.** Heart rate and blood pressure changes following labetalol administration. Downwards arrow (↓) indicates times of labetalol use. N.B. bpm = heart rate in beats per minute.
receptor vasoconstriction in the setting of stimulant-induced toxicity. However, the use of labetalol with its dual alpha and beta receptor blocking properties might be useful in these scenarios. In addition, labetalol has been used to treat hypertension in patients with non-drug-induced hyperadrenergic states such as pheochromocytoma. Although labetalol is 5-10 times more potent at the beta receptor than the alpha receptor, the combination of alpha and beta blockade using labetalol may be an effective and safe treatment option in patients with methamphetamine associated supraventricular tachydysrhythmias [3].

A systematic review of 227 patients with amphetamine use and beta blocker treatment only found one putative case of unopposed alpha receptor stimulation [4, 5]. This case demonstrated an increase in BP to 240 systolic from 200 mmHg after administration of practolol. The patient recovered without further intervention. There have been no cases reporting this phenomenon with the use of labetalol and methamphetamine use in the few reported in the literature.[3]

A 24-year-old male “snorting” cocaine and methamphetamine who developed a hyperadrenergic state including tachycardia (129 bpm) and chest pain (ECG showing ST segment depression) was treated with lorazepam without resolution of symptoms. There was temporal relief of chest pain and resolution tachycardia and ST depression on ECG post administration of 5 mg IV labetalol. There were no reported adverse effects of the labetalol [6].

The evidence base supporting the use of labetalol for the management of stimulant induced cardiovascular dysfunction remains limited. Other options for treating tachydysrhythmias include calcium channel antagonists, benzodiazepines, and electrical cardioversion [7, 8].

This case suggests that labetalol is safe and effective in treatment of methamphetamine associated supraventricular tachydysrhythmias.

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