Successful use of high-dose insulin therapy in atenolol overdose refractory to conventional management

Sir,

Atenolol is a selective beta-1 adrenergic antagonist and has a longer half-life than most similar agents widely prescribed for hypertension, ischemic heart disease and certain dysrhythmias. Atenolol overdose causes hypotension, Bradycardias, decreased systemic vascular resistance (SVR) and cardiogenic shock. Management of life-threatening β-blocker toxicity and its low cardiac output state is clinically challenging. We are reporting a case of atenolol overdose associated with Bradycardias in which institution of high-dose insulin (HDI) therapy led to a dramatic improvement after failure of conventional therapies.

A 25-year-old, 55 kg woman presented to the Emergency Medicine Department approximately 3 h after ingestion of 20 tablets of 50 mg Atenolol extended release (1000 mg) and 600 mg of methyldopa and 2500 mg of ciprofloxacin. Her past medical history was insignificant except for gestational hypertension and was advised antihypertensives-atenolol and methyldopa. On arrival to Emergency Department, patient’s Glasgow coma scale (GCS) was 15/15-E4M6V5, heart rate (HR): 74 bpm, blood pressure (BP): 100/60 mm Hg, CRFT <3 s.

Electrocardiogram (EKG) showed sinus rhythm. Over the next 5 h later patient complained of giddiness and EKG revealed a sinus bradycardia of 50 bpm [Figure 1]. In view of bradycardia associated with syncope IV atropine of 0.6 mg was repeated 4 times over 30 min. Bradycardia was refractory to therapy hence patient was started on dopamine infusion. Ultrasound assessment showed normovolemia and screening ECHO showed good left ventricular (LV) function. Target (mean arterial pressure) was achieved transiently, but the patient deteriorated by 20 h postingestion with EKG.

Exactly, 12 h postingestion patient complained of chest discomfort. On vital check found to be having BP: 80/60 mm Hg, with a HR of 52 bpm and EKG showing showing conduction disturbances-first degree heart block associated with interventricular conduction delay-duration of QRS complex >120 ms [Figures 2 and 3]. Dobutamine and norepinephrine supports were added and 100 ml of 8.4% sodium bicarbonate given over 3 h. 24 h postingestion HDI or hyperinsulinemic-euglycemic (HIE) therapy was initiated, one insulin bolus of 1 U/Kg = 50 UNITS, IV
stat followed by human insulin infusion continued at 05 U/Kg/h = 25 U/H. Initial bolus of 100 ml of 25% dextrose was administered while giving insulin bolus, followed by 10% dextrose at 100 ml/h. After about 20 h of HIE therapy and 45 h postingestion, electrocardiogram showed sinus rhythm with a HR of 94 bpm and two-dimension ECHO showed adequate LV function, BP: 130/80 mm Hg and GCS: 15/15 [Figure 4]. Patient was discharged safely after 4 days after admission and was followed up after a week to look for any delayed effects [Figure 5].

The management of beta-blocker toxicity is aimed at reversing myocardial depression and thereby improving hemodynamics. The conventional approach to beta-blocker toxicity may include isotonic crystalloid boluses, glucagon, atropine, and catecholamines. Unfortunately, these interventions may not improve hemodynamic parameters or ensure the survival in severely intoxicated patients.[1]

Variable results and failures in severe poisonings have led clinicians toward alternative therapies including HDI or HIE therapy and intravenous lipid emulsion therapy.

Recent experimental data and clinical experience suggest HDI may have a greater effect on hemodynamic stability than conventional measures, and it warrants earlier consideration in the management of beta blocker overdose.[2-4]

There are many proposed and proven mechanisms for the major salient effects of HDI in beta-blocker and calcium channel blocker poisoning and cardiogenic shock induced by these drugs. In general, these fall into three categories:

1. Increased inotropy,
2. Increased intracellular glucose transport and
3. Vascular dilatation. Intracellular transport of glucose in cardiac and skeletal muscle is greatly enhanced by insulin and has been implicated as an essential component of its inotropic properties. Stressed myocardium primarily uses glucose as the preferred energy substrate, while preferring fatty acid oxidation under normal conditions.[3]

These glucose transport mechanisms that enhance inotropic function have been demonstrated in human explanted hearts.[3]

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