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High-dose insulin: A less known novel antidote in the management of β blocker poisoning

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Clinical Vignette: A 48-year-old female with a past medical history of diabetes, hypertension, depression, substance abuse, and hypothyroidism was brought into the ED following an unknown amount of atenolol consumption and loss of consciousness. She consumed this unknown amount of atenolol after sexual abuse. On examination she was found to be agitated with a temperature 97.2°F, blood pressure 84/50, pulse rate 52, respiratory rate of 16. EKG revealed sinus bradycardia at the rate of 52 and intra-atrial conduction delayed. Her blood pressure did not improve despite 3000 mL of normal saline bolus. Bolus regular insulin was given at 1 U/kg body weight along with 5 mg glucagon and 3 g of calcium gluconate; followed by 1 U/kg body weight/ hour regular insulin drip for an hour following which the patient's blood pressure stabilized. IV boluses with normal saline was used to maintain mean arterial pressure > 65 mm of Hg thereafter. Hypoglycemia and Hypokalemia associated with high-dose insulin therapy was appropriately managed with dextrose and potassium supplementation.

Discussion: Beta blockers are used for management of various cardiovascular diseases and are the fifth most dispensed medication in the United States. Middle-aged woman have a higher prevalence of cardiovascular diseases and the prevalence of depression among this age group is 22%. The risk of suicide per year among the depressed is 15%. Medication overdose is the leading cause of suicide among the middle aged.

Maintenance of hemodynamic stability is the main aim in the management of the beta blocker poisoning. A variety of agents like intravenous fluids, glucagon, calcium gluconate, and insulin are used. High-dose insulin is increasingly being used as an antidote in the management of beta blocker poisoning. However, our literature review did not reveal any case reports or clinical trials where high-dose insulin alone is used for management or to compare with other agents in the management of beta blocker poisoning. Most reported case reports described use of combination of drugs including high-dose insulin in the management of beta blocker poisoning. Multiple mechanisms have been attributed for the effectiveness of high-dose insulin in the management of beta blocker poisoning among which insulin remains the metabolic rescue. Cardiomyocytes switch from fatty acids to glucose as a chief energy source under stressful condition. Insulin dependent uptake of glucose by cardiomyocytes is the principle way of glucose uptake by cardiomyocytes in stressful situations. The decrease inotropy of the heart is also partly attributed to the blockade of beta-adrenergic receptors from beta blockers which renders decreased activation of adenylyl cyclase. This results in decreased phosphorylation of L-type calcium channels in cardiomyocytes, which leads to decreased calcium entry into the cells and hence decreased myocardial contraction. Beta blockers are also known to decrease gluconeogenesis, glycogenolysis and insulin release from pancreas, which together compromise the availability of glucose to cardiomyocytes under the stressful situation. Despite the theoretical effectiveness of high-dose insulin in the management of beta blocker poisoning randomized controlled trials are lacking to establish their effectiveness and to compare their efficacy against various other antidotes used in beta blocker poisoning.

Biography

Robert Adrah is originally from Ghana, West Africa. He completed a Bachelor of Science in Medical Sciences at the University of Ghana and continued on to obtain his medical Degree from the University of Ghana. Currently Dr. Adrah is a second year resident physician of Internal Medicine at Brookdale University Hospital and Medical Center, in Brooklyn, New York. He is working towards a career in cardiology.

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