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Case Report

Atenolol overdose successfully treated with hemodialysis - a case report

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ABSTRACT

Atenolol is a cardio selective beta-blocker and its toxicity often leads to severe hemodynamic instability and contributes to mortality. A significant number of fatal poisonings are caused by beta blockers and supportive therapy is the cornerstone of treatment. We report a case of atenolol toxicity, who had bradycardia and severe hypotension. The patient was administered with high dose insulin therapy, glucagon infusion, lipid emulsion therapy and vasopressors to maintain the mean arterial pressure (MAP) and normal heart rate. Despite these, the patient did not show any clinical improvement. Owing to the favourable hydrophilic and pharmacokinetic characteristics of atenolol, we have administered hemodialysis treatment, with which subsequent improvement in hemodynamic and clinical parameters were observed. The management of atenolol overdose was thus successful with hemodialysis.

Keywords: Atenolol toxicity, Hemodialysis, Hypotension, Hemodynamic instability

INTRODUCTION

Atenolol, a β1-selective beta-adrenergic receptor blocker, is commonly prescribed for the treatment of cardiovascular diseases. This can be attributed to its positive safety profile and high selectivity for beta-adrenoceptors.[1] From a pharmacokinetic point, atenolol exhibits a half-life ranging from 6 to 7 hours, with the majority of its elimination (95%) occurring through renal excretion.[2] Since atenolol is dialysable, it is possible to initiate hemodialysis to eliminate the drug if the patient presents within the first 24 hours of ingestion.[3] A hybrid sustained low-efficiency dialysis treatment (SLED) method might be beneficial in treating the hemodynamic stability of severe atenolol overdose and literature search shows limited number of cases about the application of SLED as a treatment modality for atenolol overdose. SLED is an intermittent treatment that provides renal replacement therapy (RRT) for a longer period of time with lowering solute clearances and ultrafiltration rates (UFR) compared with intermittent haemodialysis (IHD).[4] The goal of SLED is to merge the hemodynamic stability provided by continuous renal replacement therapy (CRRT) with the efficiency offered by intermittent haemodialysis (IHD).[5] We describe a case of atenolol overdose, which was managed successfully with SLED.

CASE REPORT

We had a 19-year-old man without any comorbidities presented with the complaints of 4 episodes of vomiting, altered sensorium and giddiness for 6 hours. There was no history of headache, fever, vomiting and chest pain. On arrival to emergency department, patient had bradycardia (45 bpm), non-recordable blood pressure (BP) and was drowsy but arousable. Patient had sudden asystole for which CPR was started and ROSC was achieved after 4 minutes of CPR. Patient was intubated. He had two episodes of recurrent asystole and was revived with CPR. Central line and arterial line were secured. The patient required high dose of noradrenaline, vasopressin and adrenaline to maintain normal mean arterial pressure (MAP) and heart rate (HR) was 55-60 bpm with normal sinus rhythm. 2D echo showed left ventricular (LV) dysfunction with ejection fraction (EF) of 35% and inferior vena cava (IVC) was dilated (Figure 1). On enquiry,

patient attenders found an empty strip of 30 tablets containing atenolol 50 mg in his bag which he might have consumed.

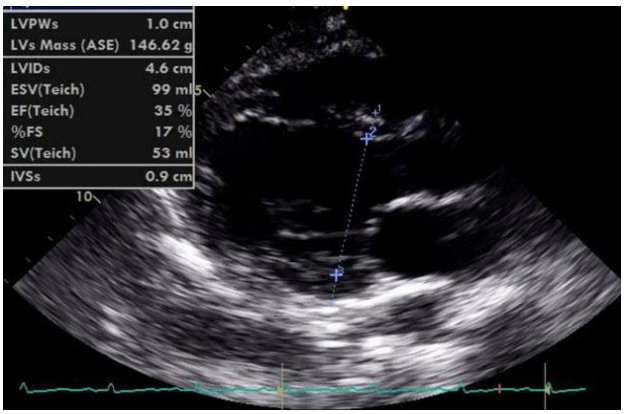

Figure 1: 2D echo with left ventricular dysfunction and ejection fraction.

Patient was shifted to ICU and put on ventilation support. He was immediately started on high dose insulin of 1 U/kg/hour and the dose was gradually increased to 8 U/kg/hour to maintain the mean arterial pressure (MAP) greater than 65 mmHg. Glucagon infusion of 2 mg/hour was started and subsequently increased to 5 mg/hour for refractory shock. 20% IV lipid emulsion at a bolus dose of 1.5 ml/kg was also given. Laboratory investigations showed creatinine- 1.5 mg/dl, hyperkalemia. Urine output was 30-40 ml/hour. After discussion with nephrologist, SLED was commenced and continued for 8 hours with an intention to remove atenolol as it has low volume of distribution. Heart rate (HR) and blood pressure have improved gradually in the next 24 hours and vasopressor requirement was significantly reduced.

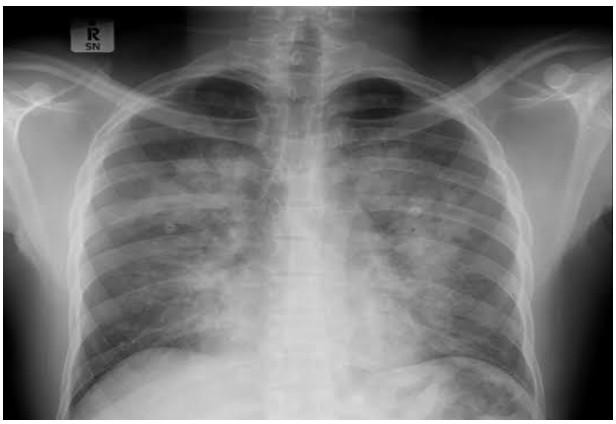

Figure 2: Respiratory distress due to pulmonary edema.

On day 2, vasopressor support was stopped, high dose insulin therapy was tapered to 1 U/kg/ hr and glucagon dose was also tapered to 1 mg/hour. Patient was continued on ventilator support. On day 3, patient was weaned off from ventilator and extubated. Patient had mild respiratory distress due to pulmonary edema and was put on non-invasive ventilation (NIV) support (Figure 2). IV diuretics were given; negative balance was achieved. On day 4, the patient's respiratory distress had reduced and the patient was stable without NIV support. 2D echo showed improved left ventricular (LV) function with EF of 60%. Insulin therapy was stopped. Persisting hypoglycemia was treated with 25% dextrose infusion. Patient was moved out of ICU on day five after attaining clinical stability and on day seven, he was discharged from the hospital.

DISCUSSION

Overdose of beta blockers typically necessitates the administration of multiple concurrent pharmacological interventions to achieve therapeutic objectives. The choice of treatment modality depends upon the patient's clinical presentation and type of beta blocker ingested.[6] Toxicity of atenolol leads to cardiac hyperpolarization which causes hypotension, bradycardia, low cardiac output and heart failure. Other presentations include bronchitis, hypoglycemia, acute renal failure, mesenteric ischemia and altered sensorium.[7]

In case of atenolol poisoning, there is evidence to support insulin therapy while preserving normal glucose levels.[8] Due to refractory hypotension in our case, high-dose insulin therapy was given with a dose of 8 U/kg/hour. Intravenous glucagon, as an inotropic agent, has been identified as the preferred treatment modality for severe beta-blocker overdose.[9] In view of persistent hypotension in our case, glucagon infusion was administered but the patient was haemodynamically not stabilized. Lipids reduces the amount of active drug available, thus enhancing heart muscle performance and action.[10] In this case, we also utilized intravascular lipid emulsion therapy, yet the patient continued to show problems with hypotension. In our case these treatments did not improve the haemodynamic instability.

Hemodialysis is generally used to treat toxicities caused by drugs which have low volume of distribution.[11] Numerous case reports have demonstrated effective treatment outcomes for atenolol overdose using haemodialysis, owing to the drug's pharmacological properties regarding solubility and movement within the body.[12,13] Our patient received eight hours of SLED in an effort to totally eliminate atenolol. The patient's heart rate and blood pressure steadily improved after SLED.

After a systematic review of 76 studies, the extracorporeal treatments in poisoning (EXTRIP) workgroup determined that dialysis decreased the mortality rate in patients with severe atenolol intoxication who also had renal impairment, refractory bradycardia, and hypotension.[14] In a case study published by Pfaender et al., the administration of continuous veno-venous hemodiafiltration therapy enabled the successful management of a severe overdose of atenolol.[15] Another case report on atenolol overdose showed 50% plasma

atenolol concentration reduction after each 5-hour intermittent hemodialysis therapy especially in patients with impaired renal function.[16] In comparison to both IHD and CRRT, SLED has shown to improve solute elimination, hemodynamic regulation, decreases the need for blood transfusions and lower the costs of critical care.[17,18] We observed significant improvement in hemodynamics and substantial reduction in vasopressor support after SLED, which probably has removed the plasma atenolol in our case. This led to stabilization, early weaning and extubation in our case of atenolol overdose.

CONCLUSION

In conclusion, SLED should be considered for patients with significant atenolol overdose, who are unresponsive to conventional therapeutic treatments.

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