Fact Sheet: High-Dose Insulin Euglycemia (HIE) As an Antidote

Off-Label Indications:
- Calcium channel blocker overdose
- Beta blocker overdose

Other Off-Label Uses:
- Drug-induced myocardial depression and hypotension unresponsive to standard therapy

Background:
Calcium channel blocker (CCB) and beta blocker (BB) toxicity can cause bradycardia, vasodilation, and decreased myocardial contractility resulting in cardiogenic shock. CCB toxicity also contributes to metabolic abnormalities by inhibiting lactate oxidation due to inhibition of pyruvate dehydrogenase. Instead of pyruvate being converted to acetyl CoA, lactate accumulates causing acidemia.

In a nonstressed state, the heart normally catabolizes free fatty acids for energy. When BBs and CCBs reach toxic levels, the heart enters a stressed state and switches over to carbohydrates as a source of energy. Insulin facilitates myocardial utilization of carbohydrates. The increased glucose uptake subsequently improves myocardial contractility restoring cardiovascular hemodynamics. Insulin can also restore lactate metabolism and prevent acidemia by restoring pyruvate dehydrogenase activity.

Dosing:
Initial bolus dose:
- 1 unit/kg regular human insulin IV bolus
- 0.5 g/kg of dextrose IV as a bolus
  a. If blood glucose is greater than 400 mg/dL (22.2 mmol/L), bolus is not necessary.

Continuous infusion:
- 0.5 to 1 unit/kg/h regular human insulin IV
- 0.5g/kg/h of dextrose IV

Adverse Effects:
- Hypoglycemia
- Hypokalemia
- Hypophosphatemia
- Hypomagnesemia

Monitoring:
- Improved contractility seen within 15 to 60 minutes
- Assess cardiac function every 20 to 30 minutes; bedside ECHO may be useful.
- If cardiac function is still depressed or there is persistent hypotension, the insulin dose can be increased.
- Doses of 2.5 units/kg/h of IV regular insulin have been used.
- Blood glucose every 30 minutes until stable, then every 1 to 2 hours. Goal: 100 to 250 mg/dL (5.5 to 14 mmol/L)
- Potassium, phosphate, magnesium levels. Goals: Improvement in organ perfusion, increased blood pressure, cardiac contractility; adequate urine output; reversal of acidemia; decreasing lactate concentrations

*Always call a poison control center (800-222-1222).

RESOURCES


