Calcium channel blocker toxicity: A case study

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No disclosures
Case

- 55 yo male
- Non-diabetic
- Took diltiazem 3000 mg
Initial management?
Calcium channel blockers

2 Classes:

Dihydropyridines
• amlodipine, nifedipine, nicardipine

Non-dihydropyridines
• Verapamil (phenylalkylamine)
• Diltiazem (benzothiazepines)
Despite structural differences between the classes, all CCBs share the common pharmacologic mechanism of binding to the alpha subunit of L-type calcium channels.
Mechanism of action

Antagonism of L-type calcium channels:

- Bradycardia
- Conduction delays
- Peripheral vasodilation
- Hypoinsulinemia
- Hyperglycemia
- Metabolic acidosis
- Shock
Mechanism of action

- Insulin secretion is a calcium channel dependent process
- Antagonism of pancreatic L-type calcium channels results in:
  - Impaired insulin secretion
  - Hypoinsulinemia
  - Hyperglycemia
Normal metabolic state

Myocytes oxidize free fatty acids for metabolic energy

State of shock

Myocytes switch to using glucose for fuel
State of shock

Hypoinsulinemia may prevent uptake of glucose by myocytes leading to:

- Loss of inotropy
- Decreased peripheral vascular resistance
Natural course of CCB toxicity

- Patients look well
- Appear well perfused
- Hypotensive

- Give a false sense of security…
Natural course of CCB toxicity

Severely intoxicated patients:

- abrupt cardiovascular collapse
First line therapy

- Intravenous calcium
- High dose insulin therapy (HIE)
- Vasopressors
Rescue Therapies

• Intravenous lipid emulsion therapy
• ECMO
• Pacemaker
Hyperinsulinemia/Euglycemia (HIE) therapy

- Increases inotropy
- Increases intracellular glucose transport to provide substrate to myocardium
- Improves peripheral vascular resistance leading to increased tissue perfusion
HIE Dosing

- 1 unit/kg bolus regular insulin
- 0.5-1 unit/kg/hour gtt regular insulin
- Titrate gtt to effect (up to 10 units/kg/h)
Case Continued

55 yo overdose with diltiazem
  • BP 60/40, HR 68

No improvement with:
  • Calcium gluconate 4 g IV
  • 2 L IVF
  • Dopamine 20 mcg/kg/min
  • Dobutamine 10 mcg/kg/min
Case Conclusion

HIE initiated at 0.5 units/kg/hour

- HR 65, BP 115/60
- Both vasopressors were discontinued within 30 minutes of initiating HIE
Thank you
References


