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)**

Mechanism of action

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

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