

# High-dose insulin euglycaemic therapy for cardiovascular instability in calcium channel blocker overdose

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## Case presentation:

- 60 year old female presented to the Emergency Department 6 hours after intentional overdose of 420mg (4.6 mg/kg) of amlodipine.
- Initial symptoms: bradycardia, hypotension, increasing agitation
- Initial management: fluid resuscitation, calcium infusion, intubation and ventilation
- Worsening cardiac instability despite noradrenaline and adrenaline infusions
- Discussion with National Poisons Information Service (NPIS) who recommended high-dose insulin euglycaemic therapy (HIET). Vasopressin and methylene blue also added and CVVHDF commenced due to worsening metabolic acidosis (Table 1)
- Recommended protocol:
  - Bolus 1U/kg = **90 units**
  - Infusion started at 1U/kg/hr and increased according to NPIS protocol to maximum dose 10U/kg/hr = **900 units/hr**
  - Further increased to 15U/kg/hr in the face of ongoing cardiac instability, as advised by NPIS = **1350 units/hr**

ICU day	Mechanical ventilation	CVVHD F	Noradrenaline	Adrenaline	Vasopressin	HIET	Methylene blue
Day 1	Yes	Yes	Yes First inotrope	Yes Second	Yes Third	Yes Fourth	Yes Fifth
Day 2	Yes	Yes	Yes	Stopped	Stopped	Yes	Stopped
Day 3	Yes	Yes	Yes	-	-	Yes	-
Day 4	Yes	Yes	Yes	-	-	Stopped	-
Day 5	Yes	Yes	Stopped	-	-	-	-
Day 6	Extubated	Stopped	-	-	-	-	-

Table 1. Organ support and vasopressor requirements during ICU stay

- Blood sugar maintained throughout with 50% glucose infusion.
- Vasopressin, methylene blue and adrenaline infusions off within next 12 hours
- HIET was stopped and restarted due to profound hypotension with discontinuation on day 3
- HIET was stopped on day 4 of ICU.
- Extubated and CVVHDF stopped on day 6
- Discharged to the ward on day 7
- Discharged home on day 16



## References

1. **Engbretsen KM et al.** High-dose insulin therapy in beta-blocker and calcium channel-blocker poisoning. Clin Toxicol (Phila). 2011 Apr;49(4):277-83.
2. **Corcoran JN et al.** Persistent Hyperinsulinemia Following High-Dose Insulin Therapy: A Case Report. J Med Toxicol. 2020 Oct;16(4):465-469.

## Discussion:

High-dose insulin euglycaemic therapy (HIET) is a recommended treatment for severe calcium channel blocker (CCB) toxicity and has been shown to be superior to conventional therapies [1].

Despite a wealth of evidence, the use of HIET is often unfamiliar to those working in a DGH ICU setting. The high doses of insulin involved, and the logistical challenge of obtaining and administering such high doses should not be underestimated.

### What did we do?

- Close communication between medical, nursing and pharmacy teams
- Cross-team checking of prescriptions and administration and reassurance that these high doses were correct
- Regular communication with NPIS
- Early discussion with nearby hospitals to ensure insulin stocks in hospital remained replete
- Ongoing education: Case presented at local Clinical Governance meeting and hospital Grand Round. Local HIET protocol being produced

### Other key learning points:

- Early use of HIET now recommended – consider in ED
- Be aware of potential complications including electrolyte abnormalities and rebound hyperinsulinaemia upon cessation of HIET [2]
- High risk of fluid overload using conventional insulin concentrations (1unit/ml). Multiple studies advocate concentrated insulin solutions (10 unit/ml) to mitigate this risk. Good communication with nursing staff and pharmacy is essential.