

CASE REPORT

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# Successful treatment of severe calcium channel blocker poisoning, new experience with the guidance of invasive hemodynamic monitoring in a 17-year-old girl: a case report

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## Abstract

**Background** Calcium channel blocker poisoning is one of the most lethal cardiac drugs overdoses. Calcium and high-dose insulin infusion are the first-line therapy for symptomatic patients, and Intralipid emulsion infusion is useful for refractory cases.

**Case presentation** In this report, we describe a 17-year-old Iranian girl who took 250 mg of the drug for a suicidal attempt and presented with refractory hypotension and non-cardiogenic pulmonary edema treated successfully with the guidance of invasive hemodynamic parameters.

**Conclusion** For complicated cases, in addition to supportive care and adjuvant therapy such as high-dose insulin and Intralipid, it is mandatory to utilize advanced hemodynamic monitoring to treat hypotension in severe calcium channel blocker poisoning to guide the treatment.

**Keywords** Case report, Calcium channel blocker poisoning, Pulse contour cardiac output

## Background

Serum ionized calcium has the main role in cardiovascular function. It acts via cardiac conduction, contraction, and preservation of vascular tone. Calcium channel blocker (CCB) overdose is rare but lethal in cardiovascular medication-related drug overdose [1, 2].

Conventional and unconventional interventions were used to treat an adolescent who ingested a life-threatening dose of amlodipine [2]. Still, these studies are more limited in children, mainly due to the lower prevalence of this poisoning at an early age; therefore, we inevitably use

adult studies when dealing with children referred with amlodipine poisoning.

Different treatment methods proposed for intoxication with this drug were based on amlodipine's pharmacological and clinical findings. These treatments include gastric decontamination, calcium, glucagon, intravenous lipid emulsion, high-dose insulin therapy, sodium bicarbonate, vasopressors, and methylene blue [3]. In some instances, studies have used unconventional but somewhat effective treatments, including electrical cardiac pacing and venoarterial extracorporeal membrane oxygenation (VA-ECMO) [4]. However, on the basis of the patient's condition, age, and the medical center facilities, a combination of these methods should be used. Due to the different treatment methods, the most critical part of deciding whether to continue treatment or use other treatment methods is to follow the patient's clinical response, as

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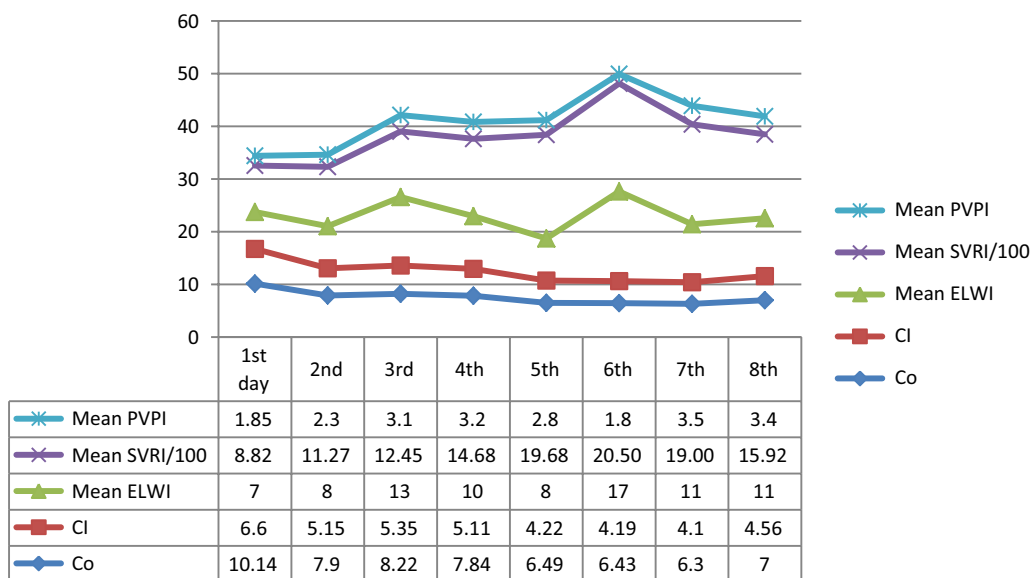
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**Fig. 2** Mean value of hemodynamic parameters during PICU care (PiCCO analysis), *CI* cardiac index, *CO* cardiac output, *ELWI* extravascular lung water index, *PPVI* pulse pressure variation index, *SVRI* systemic vascular resistance index

we again administered Intravenous Lipid Emulsion (ILE) over 2 hours, and although it was about 26 hours after her admission, the hemodynamic parameters improved significantly (MAP and SVRI increased) (Table 1, Fig. 2); so there might be a role for delayed prescription of ILE in CCB overdose [10].

Amlodipine has a myocardial depressant effect via blocking L-type calcium channels to result in cardiogenic pulmonary edema. However, non-cardiogenic pulmonary edema also was seen in a few patients, but the mechanism of non-cardiogenic pulmonary edema is not precise. Some authors proposed that precapillary dilatation can increase pulmonary transudation and interstitial edema [11–13]. On day 3 of PICU admission, the pulmonary vascular permeability index and ELWI increased, and PaO<sub>2</sub> decreased, so a chest X-ray was taken to evaluate pulmonary edema. Our patient had a normal echocardiogram, and PiCCO parameters were not indicative of volume overload or cardiac function impairment (CI and CO were normal), but PVPI and EVLWI were increased, which indicated increased permeability of pulmonary vessels and interstitial edema; all data were in favor of non-cardiogenic pulmonary edema.

Hemodynamic management, hydration, and selecting the type of inotrope or vasopressor are challenging in treating CCB poisoning. We cannot solely rely on clinical data that could be misleading, so early transferring to ICU invasive hemodynamic monitoring in severe cases is vital.

In addition to supportive care and adjuvant therapy, such as high-dose insulin and Intralipid, it is

mandatory to utilize advanced hemodynamic monitoring to treat hypotension in severe CCB poisoning to guide treatment.

**Abbreviations**

- DBP Diastolic blood pressure
- ILE Intravenous Lipid Emulsion
- AKI Acute kidney injury
- BP Blood pressure
- CCB Calcium channel blocker
- CI Cardiac index
- CVP Central venous pressure
- ER Emergency room
- EVLWI Extravascular lung water index
- GCS Glasgow Coma Scale
- GEDI Global end-diastolic index
- GEDV Global end-diastolic volume
- GEF Global ejection fraction
- HR Heart rate
- ITBI Intrathoracic blood volume index
- ITBV Intrathoracic blood volume
- MAP Mean arterial blood pressure
- PiCCO Pulse contour cardiac output
- PICU Pediatric intensive care unit
- PPV Pulse pressure variation
- PPVI Pulse pressure variation index
- SBP Systolic blood pressure
- SCVO<sub>2</sub> Central venous oxygen saturation
- SSV Stroke volume variation
- SVRI Systemic vascular resistance
- SVV Stroke volume variation
- VA-ECMO Venoarterial extracorporeal membrane oxygenation

**Acknowledgements**

The authors are grateful to the PICU nurses at Namazi Hospital. The latter was involved in this patient's care. We would also like to thank Shiraz University of Medical Sciences, Shiraz, Iran; Center for Development of Clinical Research of Nemazee Hospital; and Dr. Nasrin Shokrpour for editorial assistance and statistical assistance.