

# Acute Refractory Hypocalcemia Following 1,1-difluoroethane Inhalation: A Case Report

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## Introduction

- Inhalants, colloquially known as “whippets”, are a heterogeneous group of substances that, as the name implies, are readily and most often inhaled recreationally for their desired euphoric effects.
- There are numerous preparations, though this paper will focus on the use of volatile solvents, such as 1,1- difluorethane (DFE) found in “Dust-Off”.
- Volatile solvents may lead to several deleterious effects on the body including arrhythmias, hypocalcemia, and multi-system organ failure.
- This report describes a case of refractory hypocalcemia in the setting of DFE abuse.
- Fluorinated ethanes have been shown to cause severe hypocalcemia by accumulation of the metabolite fluorocitrate in tissues.

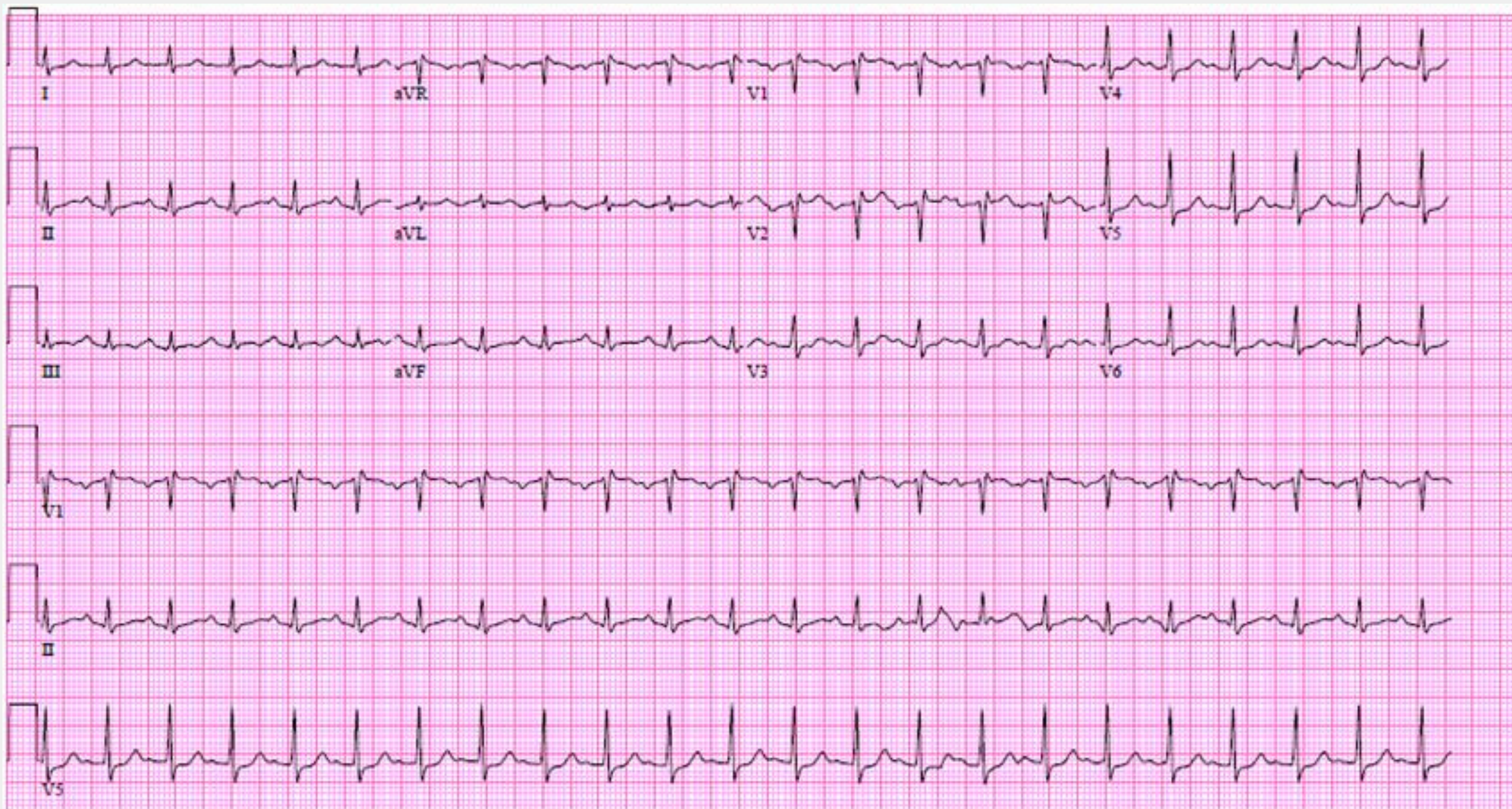
## Patient Description

- A 34-year-old male with a history of chronic inhalant and alcohol abuse presented to the emergency department (ED) with general malaise, paresthesias, and dyspnea after inhaling seven cans of Dust-Off in the preceding 36 hours.
- He arrived in extremis, tachycardic at a rate of 163, febrile to 38.2o, tachypneic, with blood pressure of 89/74 mmHg.
- The physical exam showed no focal findings or symptoms of hypocalcemia.
- White blood cell count was 22.1 x 103/uL, estimated creatinine clearance 59 mL/min, anion gap 30, lactic acid 14.9 mmol/L, bicarbonate 15 mmol/L, magnesium 0.9 mg/dL, ionized calcium 1.00 mmol/L, and serum pH 7.13 (Table).
- Despite receiving a total of 5 grams of intravenous 10% calcium chloride and 2 grams magnesium sulfate, the calcium only briefly increased.
- His ECG demonstrated sinus tachycardia (ST) with normal QTc. His rhythm then degenerated into polymorphic ventricular tachycardia that briefly responded to electrical cardioversion and initiation of IV amiodarone.

Table. Ionized calcium levels

| 08:53          | 11:04          | 11:12          | 11:30          | 11:48          | 12:14          | 12:47          |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1.00<br>mmol/L | 0.84<br>mmol/L | 0.83<br>mmol/L | 0.50<br>mmol/L | 1.15<br>mmol/L | 1.10<br>mmol/L | 0.88<br>mmol/L |

Figure. Initial EKG demonstrating sinus tachycardia



## Intervention

- The patient was transferred by helicopter to a tertiary care center, with ventricular fibrillation while enroute that responded to defibrillation.
- On arrival at the tertiary care center, his rhythm degenerated into refractory polymorphic ventricular tachycardia then ventricular fibrillation that was unresponsive to DCCV or defibrillation.
- He was started on venous-arterial extracorporeal membrane oxygenation (VA ECMO) cannulation and intra-aortic balloon pump with concurrent use of inotropes and vasopressors.
- Despite these interventions, the patient progressed from ventricular fibrillation into asystole without discernible cardiac activity by transesophageal echocardiogram and ultimately cessation of resuscitation efforts.

## Discussion

- This case report demonstrates pathologic in vivo hypocalcemia in the setting of “whippet” (DFE) use and the profound cardiac collapse that followed.
- Patients presenting with hypocalcemia and tachyarrhythmias in the setting of inhaled solvents should receive electrolyte replacement and aggressive hemodynamic support.
- Further confounding the patient's electrolyte derangements is chronic alcohol use, which is well known to result in hypomagnesemia. Magnesium stores below 1.0 mmol/L may precipitate PTH resistance resulting in hypocalcemia.
- As the patient’s cardiac rhythm degenerated from supraventricular tachycardia to polymorphic ventricular tachycardia, the patient’s hypomagnesemia in addition to hypocalcemia likely played a role in his eventual inability to return of spontaneous or mechanically assisted circulation.

## Conclusions

- This case report adds to the scant literature base that demonstrates pathologic in vivo hypocalcemia in the setting of “whippet” (DFE) use and the profound cardiac collapse that followed.
- Patients presenting with hypocalcemia and tachyarrhythmias in the setting of inhaled solvents should receive electrolyte replacement and aggressive supportive care.
- Further areas of research include public education regarding the dangers of inappropriate inhaled solvent use as well as compiling other similar case reports for more effective treatments.