

CASE REPORT

A rare case of fatal stroke after ethylene glycol toxicity

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SUMMARY

A 58-year-old man presented to the emergency department with acute left-sided weakness and left visual field defect. His examination was significant for confusion, acetone odour, tachycardia and tachypnoea. Further blood tests revealed an anion gap of 31 mEq/L, serum osmolal gap of 34 mOsm/kg, and creatinine 3.6 mg/dL. Brain MRI revealed acute infarctions scattered throughout the brain along with generalised oedema. The patient deteriorated rapidly and soon thereafter it was reported that a bottle of antifreeze was found near him at home. Haemodialysis was initiated and the patient received fomepizole and bicarbonate. Three days later the patient did not show any neurological improvement and expired later that day. Ethylene glycol toxicity can rarely present with stroke which can be life-threatening when not diagnosed and managed in a timely fashion.

BACKGROUND

Ethylene glycol is a clear water-soluble liquid used as an antifreeze in automobiles, air conditioning systems and radiator fluid. Ethylene glycol toxicity is very common worldwide due to its sweet taste and easy accessibility. It can affect the kidneys, heart, lungs and neurological system.^{1 2} The toxicity is mainly caused by the deposition of its metabolic end product calcium oxalate crystals in various organs.³

CASE PRESENTATION

A 58-year-old man with a history of hypertension, seizures and chronic kidney disease presented to the emergency department as a stroke alert with acute left-sided weakness and left visual field defect. He also had a history of depression and a previous suicide attempt. His examination was significant for confusion, acetone odour, tachycardia and tachypnoea.

INVESTIGATIONS

An arterial blood gas showed pH 7.18, pCO₂ 18 mm Hg and pO₂ 43 mm Hg. His blood glucose level was 104 mg/dL. These findings heightened a concern about a type of alcohol ingestion and further laboratory tests revealed anion gap of 31 mEq/L, serum osmolal gap of 34 mOsm/kg and a creatinine 3.6 mg/dL. CT of the head (figure 1) showed multiple infarcts.

DIFFERENTIAL DIAGNOSIS

- ▶ Methanol toxicity
- ▶ Diethylene glycol poisoning
- ▶ Propylene glycol toxicity

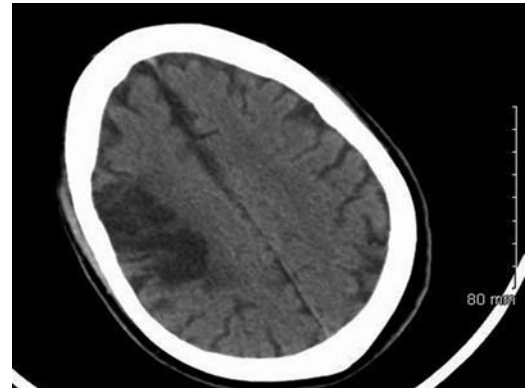


Figure 1 CT of the head showing infarcts.

TREATMENT

The patient deteriorated rapidly and lost consciousness which required intubation. Soon thereafter, it was reported that a bottle of antifreeze was found near him at home. Fomepizole was started along with a bicarbonate drip. Haemodialysis was also initiated and blood was sent for the serum ethylene glycol levels. Urine was positive for the dumbbell and needle shaped calcium oxalate crystals. The patient then developed status epilepticus for 7 min which was eventually controlled with lorazepam. Brain MRI (figure 2) revealed acute infarctions scattered throughout the brain along with generalised oedema. He remained dialysis dependent. The serum level of ethylene glycol came back as 24 mg/dL.

OUTCOME AND FOLLOW-UP

Three days after discontinuing sedation, the patient was not following commands and showed no neurological improvement. Owing to the severity of presentation and his hospital course, the family decided to withdraw life support and he expired later that day.

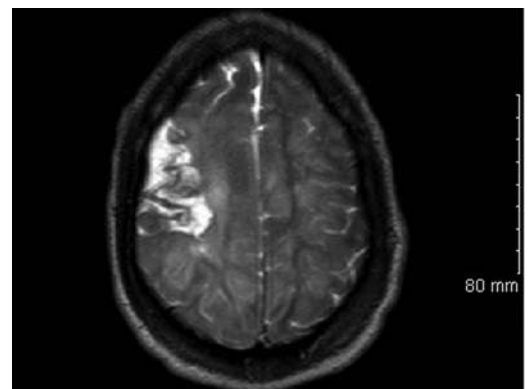


Figure 2 MRI of the brain showing infarctions with oedema.



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DISCUSSION

Ethylene glycol toxicity is a medical emergency associated with high morbidity and mortality that can be drastically reduced with prompt diagnosis and appropriate treatment. Ethylene glycol is usually ingested accidentally or by persons attempting suicide. The rapid absorption of ethylene glycol by the gastrointestinal tract leads to its quick redistribution in various organs. Ethylene glycol is relatively non-toxic before being converted to its toxic metabolites. It is rapidly metabolised to glycolaldehyde then glycolic acid via alcohol dehydrogenase and aldehyde dehydrogenase, respectively. Glycolic acid, the main culprit of the metabolic acidosis, gets converted slowly to glyoxylic acid and oxalic acid. The latter interacts with calcium in the tissues to form calcium oxalate crystals which remain in the body for many days.^{4 5} A possible explanation of stroke and cerebral infarction is the precipitation of oxalate crystals in the cerebral blood vessels leading to their obstruction.⁶

The clinical manifestation of ethylene glycol toxicity includes central nervous system (CNS) depression, cardiopulmonary symptoms and renal failure.⁷ The severe neurological damage in ethylene glycol poisoning such as a stroke is a rare manifestation. The involvement of the CNS can range from slurred speech and confusion to seizures and coma. Delany and Jay⁸ reported a case of ethylene glycol toxicity that led to cranial nerve palsy and elevated intracranial pressure. Imam *et al*⁹ reported three cases of severe neurological damage from 2009 to 2012. Out of three, one patient expired and two were left with severe neurological disability. Ohmori *et al*¹⁰ reported a case of ethylene glycol poisoning complicated by severe neurological damage leading to reduced level of consciousness which was reversed by timely intervention.

Ethylene glycol toxicity can be fatal in 24–36 h if not treated in a timely manner.¹¹ As little as 30 mL (two tablespoons) can cause severe toxicity and death. The rapid diagnosis of ethylene glycol toxicity can abort or reduce patient morbidity and severity of neurological damage. The diagnosis of ethylene glycol poisoning is challenging. A detailed history, clinical examination and laboratory evidences are the mainstay of the diagnosis. The measurement of serum ethylene concentration is definitive but not widely available.¹²

Although our patient presented with confusion, the history of antifreeze bottle at home, acetone odour on physical examination, and high anion gap with high osmolal gap acidosis on arterial blood gas raised the concern of this diagnosis. Other causes of high anion gap and elevated osmolal gap acidosis are methanol toxicity, diethylene glycol poisoning and propylene glycol toxicity. Methanol toxicity is associated with visual symptoms and treated in a similar fashion to ethylene glycol.¹³ Diethylene glycol and propylene glycol are pharmaceutical solvents; the former usually presents with neuropathies and the latter presents in intensive care unit settings with the overdose of benzodiazepines and barbiturates.^{14 15}

Fomepizole, a reversible inhibitor of alcohol dehydrogenase enzyme, has been approved by the US Food and Drug Administration for the treatment of ethylene glycol poisoning.¹⁶ Prompt treatment with fomepizole in patients with high suspicion of ethylene glycol toxicity or who present with high anion gap and high osmolal gap metabolic acidosis with uncertain diagnosis is necessary to reduce the severity of end-organ damage. This will protect the patient until the definitive diagnosis is made. Fomepizole blocks the production of new toxic acid metabolites, but it alone does not reverse or prevent the

end-organ damage or metabolic derangements caused by the previously formed toxic metabolites. Aggressive treatment with intravenous sodium bicarbonate and haemodialysis are necessary to manage advanced ethylene glycol poisoning. The removal of parent alcohol and its toxic metabolites is possible by haemodialysis which is considered essential for toxin removal and supportive care in patients with renal failure secondary to ethylene glycol poisoning.

Learning points

- ▶ High index of suspicion for ethylene glycol poisoning is essential in patients with profound anion gap metabolic acidosis and high osmolal gap.¹⁷
- ▶ Prompt haemodialysis and treatment with bicarbonate and fomepizole are the cornerstones of managing this toxicity.^{18 19}
- ▶ Severe ethylene glycol poisoning may imitate other clinical conditions, including stroke, sepsis and ethanol intoxication. Clinical work-up of patients who present to hospital with altered level of consciousness should include prompt assessment of serum bicarbonate and/or arterial blood gases with determination of anion gap and osmolar gap (corrected for serum ethanol concentration).

Contributors All authors participated and contributed in writing this manuscript.

Competing interests None.

Patient consent Obtained.

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