Prehospital diagnosis of massive ethylene glycol poisoning and use of an early antidote

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Received 25 August 2005; received in revised form 19 December 2005; accepted 19 December 2005

Keywords
Ethylene glycol; Poisoning; Prehospital care; Fomepizole; Portable analyser

Summary
We report the case of a patient suspected of voluntary massive poisoning by ethylene glycol. Prehospital diagnosis was established by portable blood analyser and an early antidote with 4 MP treatment initiated in out-of-hospital setting. Use of portable blood analyser in prehospital care should be considered in case of suspected massive poisoning by ethylene glycol.

Case report
A 38-year-old man with a history of depression was found by his wife, unconscious in his cellar. When the emergency medical services arrived on scene, the patient was hypotonic and hyporeflexic, with a Glasgow coma scale score of 3, without localizing signs. The arterial blood pressure was 130/85 mmHg, heart rate 100 beats/min, respiratory rate 28/min (Kussmaul type) with probable pulmonary aspiration. Oxygen saturation by pulse oximetry was 98% while breathing room air. An empty automotive antifreeze bottle (500 mL) was found close to the patient. No other drugs or alcohol were thought to have been taken.

Electrolyte and arterial blood gas analyses were obtained at the site using the i-STAT® portable analyzer (Abbott Laboratory, Abbott Park, Illinois, U.S.A.). The results showed a significant metabolic acidosis with increased anionic gap (pH 7.1, HCO₃⁻ 5 mmol/L, lactate 3.6 mmol/L, Na⁺ 143 mmol/L, Cl⁻ 101 mmol/L, K⁺ 4 mmol/L, anion gap 32 mmol/L). The blood glucose concentration was normal.

Massive voluntary ethylene glycol poisoning was suspected immediately. After tracheal intubation and mechanical ventilation, an infusion of 4-methylpyrazole (Fomepizole) was begun at the scene with a loading dose of 15 mg/kg. The patient was transferred to a toxicology intensive care unit.
was 54.5 \mu\text{mol}/l (343 mg/ml). Fomepizole was continued, together with urinary alkalinisation and haemodialysis to increase toxin elimination, to correct metabolic disorders and to treat renal dysfunction. Thirty days after his admission, the patient was transferred to a psychiatric unit without sequelae.

Discussion

We present the first reported case of prehospital treatment of massive ethylene glycol poisoning with 4-methylpyrazole without benefit of a pre-treatment confirmatory diagnosis. The diagnosis was made by the physician at the scene on clinical (history of depression, coma, and antifreeze bottle) and biochemical grounds (major metabolic acidosis with increased anion gap, without a major elevation of blood lactate). The normal glucose level made ketoacidotic coma unlikely, and shock with hypoperfusion as a cause of the coma was excluded by the lactate level.

The portable i-STAT® laboratory is very simple and quick to use and gives results such as these in 3–5 min with a very small blood sample (less 1 mL). Ethylene glycol poisoning may cause severe morbidity and death. Although not toxic itself, ethylene glycol is converted by hepatic alcohol dehydrogenase to active metabolites that cause metabolic acidosis, renal failure, cardiovascular dysfunction, and damage to the central and peripheral nervous system. The standard treatment is inhibition of alcohol dehydrogenase with ethanol or 4-methylpyrazole (4-MP) and adjunctive haemodialysis. Ethanol itself is hepatotoxic and can lead to hypoglycaemia. The blood ethanol concentration must be measured frequently to adjust dosage. In contrast, 4-MP appears to have none of the adverse effects of ethanol administration and has a longer half-life. Plasma concentration measurements are not necessary.

Early use of 4-MP in ethylene glycol poisoning not requiring haemodialysis has been reported. In our case report, the intoxication was massive, and coma (which generally appears 4–6 h after ingestion of ethylene glycol) was profound. The coma was associated with rhabdomyolysis and massive metabolic acidosis. Renal failure and metabolic disorders necessitated haemodialysis.

Plasma ethylene glycol sampling, to confirm the diagnosis, is not imperative before commencing 4-MP because of its lack of serious side effects. Alcohol ingestion must be sought when ethylene glycol poisoning is suspected because it can initially mask metabolic disorders which become manifest only after ethanol elimination.

Conclusion

Technical advances now allow rapid biochemical testing at the bedside. The portable i-STAT® is a commonly used medical device which can confirm the clinical diagnosis and permit pre-hospital treatment.

References