WESTMEAD HOSPITAL

Health
Western Sydney
Local Health District

MANAGEMENT OF A RARE CASE OF MASSIVE DELIBERATE SELF-POISONING WITH ETHYLENE GLYCOL

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Background: Brake fluid is a non-corrosive substance that is primarily composed of ethylene glycol. It is the metabolites of ethylene glycol that are toxic to humans and, therefore, signs and symptoms of toxicity are delayed. Patients with ethylene glycol poisoning initially experience central nervous system depression and, as a result, commonly present with similar symptoms to alcohol intoxication. As metabolites accumulate (approximately 12 hours after ingestion), cardiorespiratory symptoms, metabolic acidosis and acute kidney failure occur (figure 1). As oxalic acid circulates it binds to calcium, forming a calcium oxalate precipitate which deposits in many organs including the kidney, resulting in tissue injury and organ failure, as well as hypocalcaemia (figure 2). Doses of 30-60mL of brake fluid have been recorded to cause permanent organ damage and death.

Presenting Complaint: A 45 year old mechanic presented to Emergency Department after intentional ingestion of 500mL brake fluid and one beer. Was admitted under toxicology to the Medical High Dependency ward.

Symptoms upon Presentation:

- Nil signs of Central Nervous System (CNS) depression
- Oxygen saturation 95% on room air
- Blood Pressure 121/82, Heart Rate 82 bpm
- Osmolality 387mmol/kg (275-295) used to calculate a patient's osmolality gap and is used to estimate the serum level of ethylene glycol

Patient History:

Nil regular medications, nil illicit drug use, no know drug allergies

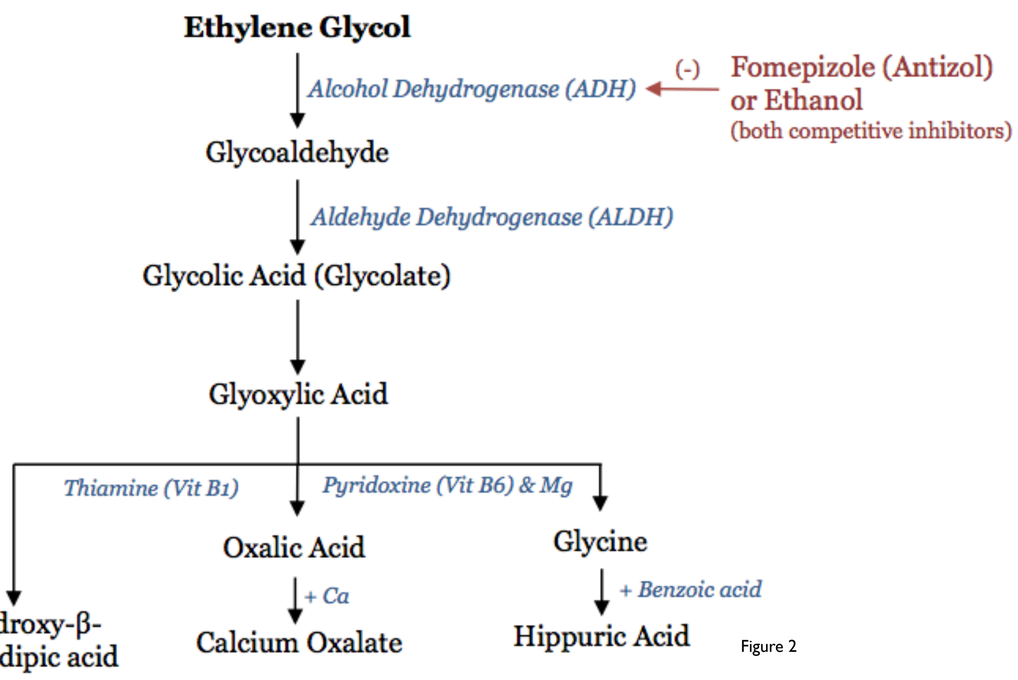


Figure 2

Treatment Options:

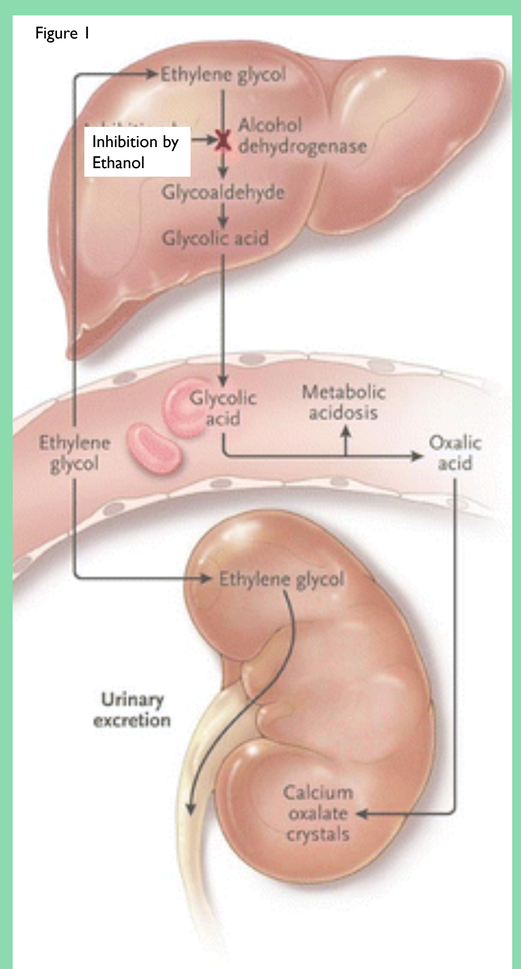
Antidotes - alcohol dehydrogenase inhibitors allows ethylene glycol to be excreted unchanged in the urine:

- Ethanol
  - Intoxication is a common side effect
  -Blood alcohol concentration monitoring required
  -Blood glucose monitoring due to risk of hypoglycaemia
- Fomepizole
  - At time of this case was only available under the Special Access Scheme Category A
  -Less profound side effects than alcohol
  -Standard dosing: does not require concentration monitoring

Other antidotes:

- Activated Charcoal
  - Poorly absorbs ethylene glycol
- Haemodialysis

Figure 1



Management of this Patient: 40% oral ethanol was compounded in the Pharmacy. Due to the polarity of ethanol and water when the two substances are mixed, they undergo molecular rearrangement through hydrogen bonding (figure 3). Therefore, this changes the volume that the liquid occupies which changes at various temperatures and, as a result, measurement of alcohol by weight yields a more accurate concentration.

- Loading dose of 1.8mg/kg of 43% ethanol, then maintenance of 0.2-0.4mL/kg/ hour to keep the blood alcohol level (BAC) between 22-33mmol/L.
- Patient loaded with 40g of ethanol and maintenance dose of 5g of ethanol Q1H was commenced → BAC was sub-therapeutic →dose was increased to 10g Q1H and the BAC was within range-24.9mmol/L (0.11%).
- Pharmacist recommended IV thiamine and pyridoxine to promote the metabolism of ethylene glycol to its non-toxic metabolites (see figure 2).

Outcome: The patient's renal function, glucose levels and osmolality gap and were closely monitored and the patient made a complete recovery. Once the patient had recovered, he was seen by the mental health team for follow up.

Aknowledgements
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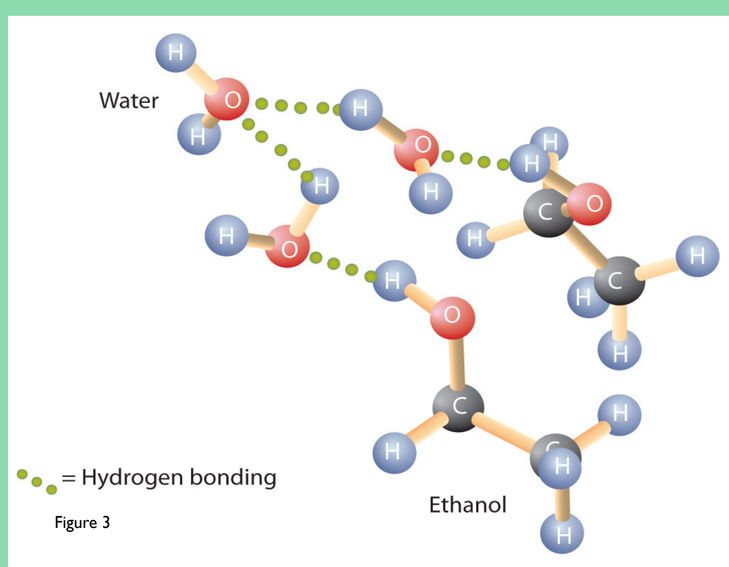

Figure 3

References: Hall AH (1992). "Ethylene glycol and methanol: poisons with toxic metabolic activation." *Emerg Med Rpt* **13** (4): 29-38. Miller H, Barceloux D, Krenzelok E, Olson K, Watson W. American Academy of Clinical Toxicology Practice Guidelines on the Treatment of Ethylene Glycol Poisoning [Internet]. 2017 [cited 3 November 2017]. Available from: https://www.ncbi.nlm.nih.gov/pubmed/10497633 . Barceloux DG, Bong GR, Krenzelok EP, Cooper H, Vale JA, American Academy of Clinical Toxicology ad Hoc Committee on the Treatment Guidelines for Methanol Poisoning (2002) American Academy of Clinical Toxicology practice guidelines on the treatment of methanol poisoning. J Toxicol Clin Toxicol 40:415–446. Elwell RJ, Darouian P, Bailie GR, et al. Delayed absorption and postdialysis rebound in a case of acute methanol poisoning. Am J Emerg Med. 2004;22:126-127. Jacobsen D, Hewlett TP, Webb R, Brown ST, Ordinaro AT, McMartin KE. Ethylene glycol intoxication: evaluation of kinetics and crystalluria. *Am J Med* 1988;**84**:145–52. Brent J. Fomepizole for Ethylene Glycol and Methanol Poisoning. New England Journal of Medicine. 2009;360(21):2216-2223. Socratic. How is molecular polarity related to solubility? | Socratic [Internet]. Socratic.org. 2017 [cited 3 November 2017]. Available from: https://socratic.org/questions/how-is-molecular-polarity-related-to-solubility. EMBConsult. Ethylene Glycol Toxicology Summary [Internet]. Ebmconsult.com. 2017 [cited 3 November 2017]. Available from: https://www.ebmconsult.com/articles/ethylene-glycol-toxicology. Lindsay Murray et al. Ethylene Glycol, Toxicology Handbook 3rd ed. Elsevier: Australia.