

# In the Glow of a Coma

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## OBJECTIVES

1. Recognize clinical features of ethylene glycol poisoning in the setting of high anion gap metabolic acidosis
2. Identify treatments for ethylene glycol toxicity

## ABSTRACT

**Background**  
Ethylene glycol is a rare but fatal cause of anion gap metabolic acidosis. Prompt recognition and treatment is essential.

**HPI**  
A 55-year-old man was brought to the ED in a coma. He was last known normal 12 hours prior to arrival.

**Vitals**  
33°C, HR 70, BP 80's/40's mmHg, RR 12. GCS 8. Intubated.

**Exam**  
Unresponsive to noxious stimuli. Reactive pupils, but absent brainstem reflexes and reduced peripheral reflexes.

**Workup**

- Unremarkable CT head
- Anion gap metabolic acidosis
- Elevated osmolar gap of 86 mOsm/kg.
- Workup for toxic ingestion: UDS showed benzodiazepine. Cyanide, ethanol, methanol, salicylate, and acetaminophen levels were undetectable.
- Urine analysis found calcium oxalate crystals
- Wood's lamp demonstrated fluorescence in patient's vomit and urine, suggesting ethylene glycol toxicity.
- Ethylene glycol level >150

**Assessment** This is a case of ethylene glycol intoxication

**Treatment** Fomepizole, pyridoxine, thiamine, dialysis

**Outcome** The patient's neurological and renal function recovered. On further questioning of the patient's family, an empty bottle of antifreeze was found at home.

## ETHYLENE GLYCOL

- Ethylene glycol is present in automotive products such as antifreeze.
- FDA approved use of fomepizole to treat ethylene glycol in 1997.
- Prior to fomepizole, ethanol was used as treatment but associated with higher rates of intubation and hepatotoxicity.

## ANION GAP METABOLIC ACIDOSIS & OSMOLAR GAP

$$9 \left( \begin{array}{c} 15 \\ 46 \end{array} \right) 200 \quad \begin{array}{c|c|c} 144 & 112 & 15 \\ \hline 4 & 4 & 4 \end{array} \left( \begin{array}{c} 120 \end{array} \right)$$

**Anion Gap: 28**

ABG **6.9/36/190/7**  
Lactate **>30 mmol/kg**

$$\text{Osmolality} = 2 \times \text{Na} + \frac{\text{Glucose}}{18} + \frac{\text{BUN}}{2.8}$$

**Normal osmolar gap: <10**

Calculated Osm 382 - Measured Osm 296  
= **Osmolar gap 86 mOsm/kg**

## WOODS LAMP



**Fig 1. Woods lamp was applied to patient's urine and vomit and showed fluorescence due to sodium fluorescein, a colorant often added to antifreeze. Fluorescence may only last for 4 hours, so false negatives are common.**

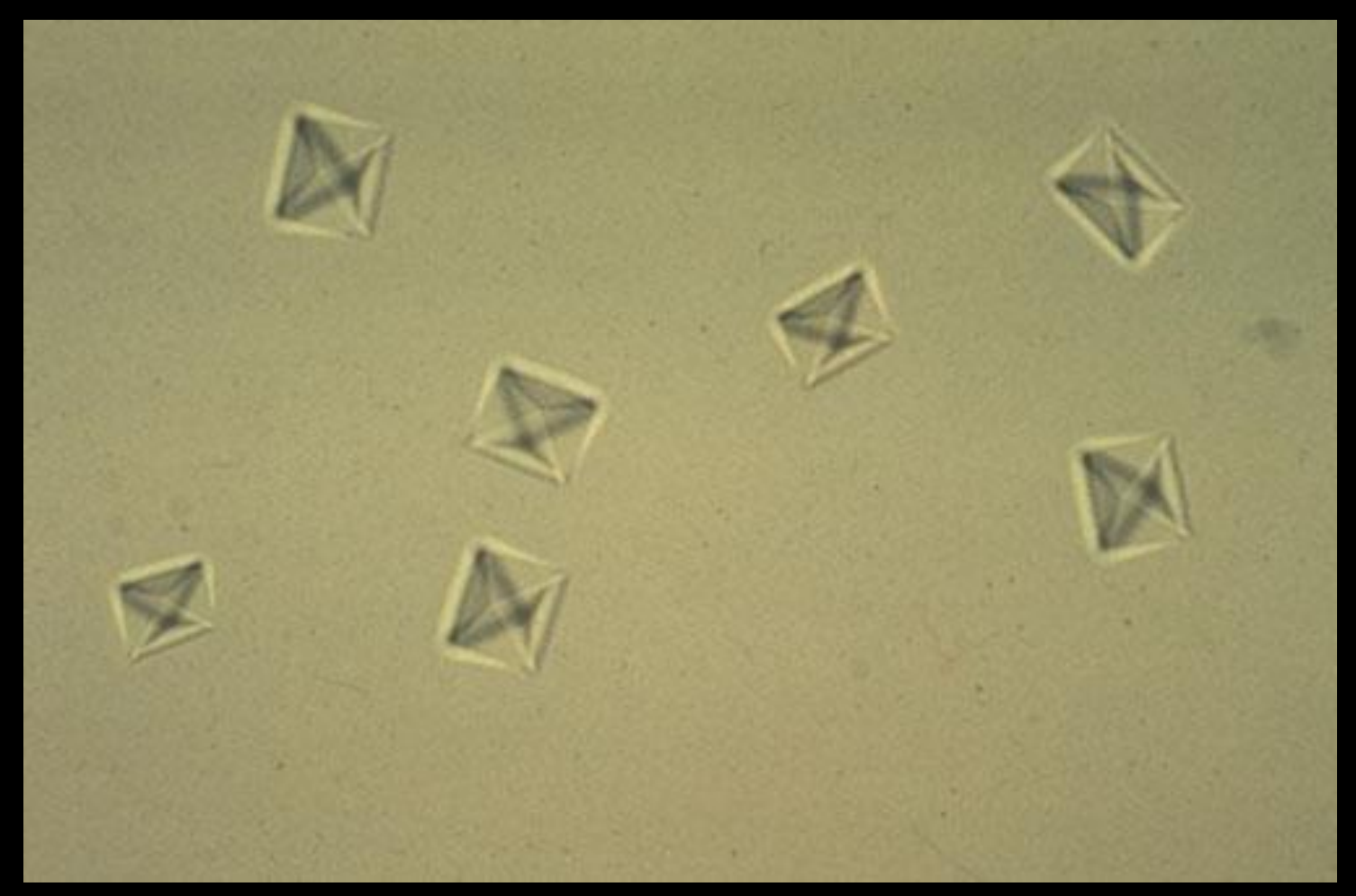
### Anion Gap Metabolic Acidosis

- C** CO, CN, Congenital CHF  
**A** Aminoglycoside  
**T** Toluene  
**M** Methanol  
**U** Uremia  
**D** DKA, ETOH Acidosis  
**P** Propylene Glycol  
Paracetamol  
**I** Iron, Isoniazid  
Inborn Error Metabolism  
**L** Lactic Acidosis  
**E** Ethylene Glycol  
**S** Salicylates

### Osmolar Gap

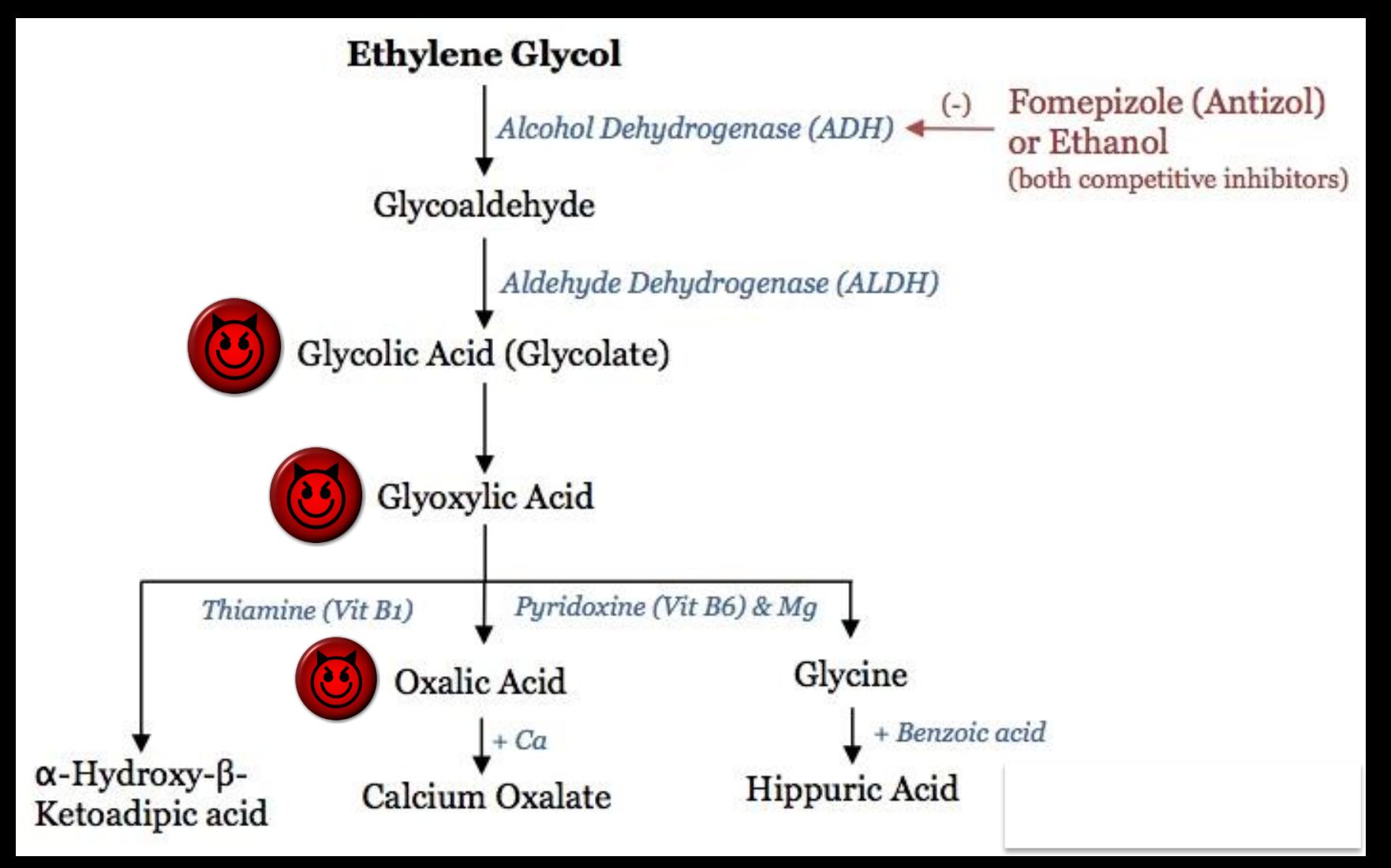
- Methanol**  
**Propylene Glycol**  
**Ethylene Glycol**  
**Diethylene Glycol**  
**Isopropyl**

## URINE CALCIUM OXALATE



**Fig 2. Urine analysis showed calcium oxalate crystals that formed from calcium binding with oxalate, an ethylene glycol metabolite. Calcium oxalate causes ATN. Loss of calcium causes QTc prolongation.**

## ETHYLENE GLYCOL METABOLISM



**Fig 3. Fomepizole inhibits ethylene glycol metabolism into toxic acids, namely glycolic acid, glyoxylic acid, and oxalic acid. Thiamine, pyridoxine, and magnesium increase metabolism of toxic acids into non-toxic acids. Dialysis clears ethylene glycol and acids.**

## DISCUSSION

- This is a case of ethylene glycol toxicity
1. Prompt recognition and treatment of ethylene glycol toxicity prevents devastating consequences
  2. Clinicians should obtain osmolar gap in unexplained anion gap metabolic acidosis
  3. Do not be fooled by high lactate. Ethylene glycol metabolites interfere with lactic acid assay causing falsely elevated L-lactate
  4. There are 3 stages of ethylene glycol intoxication
    - 1) Neurologic: 0.5-12 hrs
      - Vomit, Nystagmus, Papilledema, Hyporeflexia, Seizures, Coma
    - 2) Cardiac: 12-24 hrs
      - HTN, QTc prolongation (hypocalcemia), Heart failure, ARDS
    - 3) Renal failure: 24-72 hrs
  4. While fomepizole is expensive ~\$1000, studies suggest fomepizole given with dialysis together reduces duration of hospitalization due to faster clearance of ethylene glycol, leading to reduced hospital cost.

## REFERENCES

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