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Antifreeze Poisoning

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Abstract

Case Presentation: A 28-year-old male presented to the emergency department after an intentional ingestion of an unknown liquid in a suicide attempt. Urine obtained from the patient demonstrated green fluorescence under Wood's lamp, supporting the diagnosis of ethylene glycol toxicity from antifreeze ingestion.

Discussion: Ethylene glycol is a toxic alcohol commonly found in antifreeze that causes multiple laboratory abnormalities, including elevations of anion gap, osmolar gap, and lactate [1,2,5]. Diagnosis can be difficult as many institutions lack a rapid or in-house serum ethylene glycol test. Most commercially available antifreeze solutions contain an additive that demonstrates green fluorescence under UV light, which can be picked up in the patient's urine. Thus, when there is high clinical suspicion for ethylene glycol toxicity due to history and laboratory abnormalities, green urine fluorescence can support the diagnosis and lead to early intervention.

Keywords: Antifreeze; Ethylene glycol; Fluorescein; Toxic alcohol

Case Presentation

A 28-year-old male with a prior medical history of anxiety, depression, and post-traumatic stress disorder was brought in by ambulance after a reported intentional ingestion of an unknown liquid with a suicidal intent.

Vital signs were: blood pressure 150/90 mm Hg; heart rate 98 beats/min; respiratory rate 20 breaths/min; temperature 36.7°C; oxygen saturation 94% on room air. Initial physical exam revealed an unresponsive patient with a Glasgow Coma Scale of [3].

Table 1: Patient's initial lab values upon presentation to the ED on the left. Reference ranges on the right.

Lab Values		**Reference Range**
pH	7.37	7.32-7.41
pCO2	37 mmHg	42-53 mmHg
HCO3	20 mEq/L	23-28 mEq/L
Lactate	10.1 mmol/L	0.7-2.1 mmol/L
Na	141 mmol/L	136-145 mEq/L
K	3.9 mmol/L	3.5-5.0 mmol/L
Cl	106 mmol/L	98-106 mEq/L
Blood glucose	107 mg/dL	70-99 mg/dL
BUN	7.15 mg/dL	8-20 mg/dL
Cr	1.2 mg/dL	0.70-1.30 mg/dL
Anion gap	15 mmol/L	7-13 mmol/L
Ca	8.7 mg/dL	8.6-10.2 mg/dL
Ethanol	Undetectable	Undetectable
Serum osmolality	311 mmol/kg	275-295 mmol/kg
Calculated osmolar gap	21	<10

Urine obtained from the patient was observed to fluoresce under Wood's lamp when compared to another patient's urine. This supported the diagnosis of ethylene glycol poisoning. The patient was given fomepizole, vitamin B1, vitamin B6, and was started on a sodium bicarbonate drip. He underwent one session of hemodialysis lasting 4 hours at a blood flow rate of 300ml/min with resolution of metabolic abnormalities. He was discharged three days after presentation. Ethylene glycol level resulted 48 hours after presentation was 589 mg/L.

Our patient's urine sample is on the right. Our control on the left was a urine sample that was taken from a different patient without antifreeze ingestion. Wood's lamp was placed behind the two urine samples and demonstrated that the patient's urine fluoresces green while the control does not.

Discussion

Ethylene glycol is primarily found in antifreeze, and most toxic ingestions of ethylene glycol are a result of antifreeze ingestion. Antifreeze preparations often include fluorescein, which is added for easier detection of leaks and spills. However, urine fluorescence is not sensitive or specific for detection of antifreeze ingestion [1]. Fluorescence can be visually detected at maximum six hours post-ingestion [2]. Furthermore, certain foods, drugs, and substances in foley bags can also fluoresce [4]. This urine test in the pediatric population gives false positives [3]. If there is high clinical suspicion for antifreeze ingestion, urine fluorescence can be a useful confirmatory test with the addition of surrogate markers.

Due to the lack of rapid ethylene glycol level detection in plasma at most facilities, surrogate markers are often used for ethylene toxicity. These include urine crystal examination, anion and osmolar gap, hypocalcemia, elevated lactate [5]. Glycolic acid, a metabolite of ethylene glycol, can be mistaken for lactate by blood gas analyzers, resulting in elevated lactate level [5]. While these surrogate markers lack sensitivity and specificity, a serum ethylene glycol level measurement is available, however often requires a send-out test that can take over 24- 48 hours to obtain results which limits its clinical use in the emergency department.

Treatment depends on the estimated dose ingested, patient's renal function among other factors. Mainstay of treatment includes fomepizole or ethanol to competitively inhibit alcohol dehydrogenase and decrease the formation of toxic metabolites [1]. Dialysis may not be necessary for all patients and is considered in patients with poor renal function, large overdoses, or electrolyte and acid base disturbances. This is in contrast to methanol ingestions where dialysis is almost always indicated for toxin elimination [1].

To conclude, utilizing urine fluorescence in an appropriate setting with a high pretest probability can assist in making a diagnosis, initiating timely treatment, and potentially preventing the need for dialysis in a subset of patients.

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