

Pick Your Poison

A 56-year-old male with a past medical history of schizoaffective disorder presents to the emergency department with an ingestion approximately four hours ago. The patient states the “voices inside his head told him to drink a bottle of rubbing alcohol.” However, the patient can neither provide further details about the incident nor specify whether he ingested any other substances. He reports two episodes of vomiting this morning. He denies any fevers, chills, abdominal pain, shortness of breath, dizziness, vision changes, headaches, or lightheadedness.

Initial vital signs:

HR: 101 bpm

BP: 130/85 mm Hg

SaO₂: 100% on room air

RR: 18 breaths/min

T: 98.7 degrees, oral

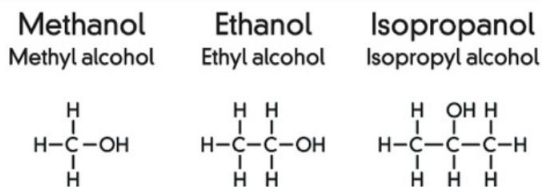
On exam, the patient is disheveled and tearful with a loose thought process, but he is in no acute distress. The patient appears to be responding to internal stimuli. He has a regular rate and rhythm and is clear to auscultation bilaterally. His abdomen is nontender to palpation. He is slightly diaphoretic with no rashes or lesions. Pupils are 2 mm bilaterally. Based on his labs, what did the patient most likely ingest?

- A. Ethanol**
- B. Methanol**
- C. Isopropyl Alcohol**
- D. Ethylene Glycol**
- E. Salicylates**
- F. Propylene Glycol**

Laboratory Results

HGB	14.0 g/dL
HCT	46%
MCV	76 fL
PLT	392,000
Na	136 mEq/L
K	3.6 mEq/L
BUN	10 mg/dL
Creatinine	0.7 mg/dL
Glucose	100 mg/dL
Anion Gap	8 mEq/L
Calcium	8.5 mg/dL
Chloride	106 mEq/L
CO ₂	23 mEq/L
AST	50 U/L
ALT	40 U/L
Serum Ethanol	113 mg/dL
Serum Salicylate	<5 mg/dL
Serum Osm	294 mOsm/kg
Urine Ketones	<5
Urine Casts	Absent

The correct answer is **A**. The patient has a serum ethanol level of 113, which indicates he was consuming standard “drinking” alcohol. Serum ethanol does not account for any other alcohols (view alcohol structures below).



Berkshire Corporation. (2021, June 9). *Toxic alcohols 101: Ethanol, methanol, isopropanol*. Berkshire Corporation. Retrieved October 9, 2022, from <https://berkshire.com/toxic-alcohols-101-ethanol-methanol-isopropanol/>

While the patient states he drank “rubbing alcohol,” also known as isopropyl alcohol or isopropanol (**option C**), the patient would have had an osmolal gap (due to unmeasured toxic alcohols) without metabolic acidosis, ketonuria (isopropyl alcohol metabolized into acetone), and more severe CNS effects, such as hypotension, hypothermia, and headaches due to the larger molecular weight. Methanol, ethylene glycol, salicylates, and propylene glycol (**options B, D, E, and F**) would all cause an anion gap metabolic acidosis (think “GOLDMARK” mnemonic), which this patient does not have. Methanol, ethylene glycol, and propylene glycol would also produce an osmolal gap. Furthermore, methanol (**option B**) metabolizes into formic acid, which can damage the optic nerve and lead to vision changes. Ethylene glycol, on the other hand, can cause acute renal failure. This patient has a normal BUN and creatinine and no signs of visual disturbances. Thus, the patient only appeared to have drunk ethanol.

Approach to Suspected Isopropyl Alcohol Ingestion

While this patient ultimately did not have isopropyl alcohol/isopropanol ingestion despite the history, ruling out this diagnosis is crucial due to possible respiratory depression and circulatory collapse. Presentation typically includes rapid inebriation, unstable vitals, hematemesis due to hemorrhagic gastritis, dizziness, and headaches. Miosis and decreased deep tendon reflexes are common physical exam findings.

When a patient presents with suspected isopropyl alcohol ingestion, workup should include a fingerstick glucose, CBC, CMP, VBG, CK, serum or urine ketones, transaminases, lactate, and acetaminophen, ethanol, and salicylate levels. Unlike the other toxic alcohols, isopropyl alcohol is the only alcohol that will produce ketosis without a metabolic acidosis, as its metabolite, acetone, is uncharged. Keep a broad differential, as alcoholics can also develop ketosis due to starvation, which would include a metabolic acidosis. ECGs should be ordered on all patients with toxic exposure. Patients may have falsely elevated creatinine levels due to acetone. Early in ingestion, patients may also have an osmolal gap, so a serum osmolality level should be obtained.

Osmolality gap equation:

Serum Osmolality – Calculated Osmolality

Calculated Osmolality:

$$2 \times \text{Na} + (\text{BUN}/2.8) + (\text{Glucose}/18) + (\text{Ethanol}/4.6)**$$

In this patient, the serum osmolality was 294 and the calculated osmolality was 306. $294 - 306 = -12$, so there was no osmolal gap. The patient also lacked ketosis, thus ruling out isopropyl alcohol ingestion.

**4.6 is used as divisor in the traditional formula based on the molar mass of ethanol, however some studies (Purssell et al. 2001, Khajuria et al. 2005, Lepeyre et al. 2017) have suggested 3.7-3.8 as divisor.

Treatments

Treatment of isopropyl alcohol poisoning is primarily supportive, with administration of intravenous fluids and pressors if hypotension is present. Patients who are unable to protect their airway should be intubated. Gastric emptying is typically viewed as futile due to the known rapid absorption. Unlike treating ethylene glycol or methanol ingestion, fomepizole is not recommended in isopropyl alcohol ingestion, as its metabolites do not result in end-organ damage and inhibition of alcohol dehydrogenase simply prolongs periods of intoxication.

Hemodialysis is rarely indicated but should be considered if serum levels are > 500 mg/dL or in the presence of an osmolar gap >100 . If a patient does not become comatose after six hours of ingestion, the patient is very unlikely to need hemodialysis. At a minimum, all patients should be monitored until clinically sober.

Take Home Points

- **Maintain a wide differential diagnosis in the setting of a suspected toxic ingestion – always inquire about the source of alcohol and any co-ingestions**
- **Early recognition is essential in toxic alcohol ingestion as these patients are at risk for significant morbidity and mortality without prompt treatment**
- **Isopropyl alcohol is the only toxic alcohol that produces ketones in the absence of metabolic acidosis**
- **Osmolar gap and anion gap are useful laboratory tests to aid in diagnosis**

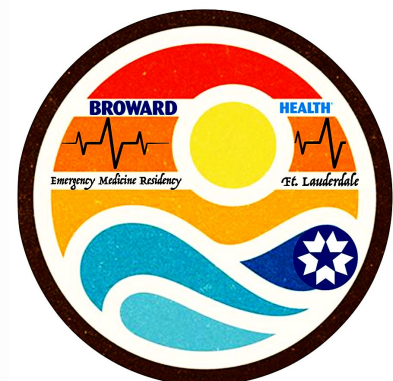


About the Author

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