

St. Patrick, the organic chemist and Sherlock Holmes meet in the emergency department: a case report

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Introduction

The following article examines an innovative approach to ethanol ingestion in an inner city hospital emergency department (ED).

Case report

A 29-year-old male presented to the Royal Alexandra Hospital ED on the evening of St. Patrick's day in 2001. His presenting complaint was general malaise, and he was well known to the department for a variety of previous mixed ingestions and minor injuries. His history was significant for alcohol abuse, with the last ethanol ingestion approximately 18 hours earlier. He was a disheveled man who appeared his stated age, with a resting tachycardia of 115 beats/min, a Glasgow Coma Scale (GCS) score of 15, and a mild resting tremor. His vital signs were otherwise normal, and the physical exam did not suggest any specific toxidromes. The diagnosis of alcohol withdrawal was made, and the patient was treated with IV thiamine, B₁₂, and dextrose-normal saline solution. The 2200 h laboratory results were as follows (normal ranges in brackets).

- Serum electrolytes: Na⁺ = 144 (133–146) mmol/L, K⁺ = 4.0 (3.5–5.0) mol/L, Cl⁻ = 112 (96–107) mmol/L, total CO₂ = 22 (23–31) mmol/L, urea nitrogen = 2.0 (2.5–8.0) mmol/L urea, glucose = 5.2 (3.3–11.0) mmol/L
- Anion gap = 10 (4–16)
- Measured serum osmolality = 320 (280–300) mmol/kg; calculated osmolality = 295 mmol/kg; osmo-

lar gap = 25 (<10) mmol/L, ethanol = 20 mmol/L, unaccounted osmolar gap = 5 mmol/kg

- Toxicology screen negative for acetylsalicylic acid, acetaminophen and barbiturates

The patient was observed and signed over to the evening physician at 2400 h with plans for continued IV hydration, benzodiazepine administration as needed, and social services consult in the morning for shelter and detoxification.

At 0200 h, the attending physician was called to the bedside to find the patient obtunded (GCS = 3), tachycardic (140 beats/min), hypotensive (85/53), and with respiratory insufficiency (respiratory rate = 4 breaths/min; oxygen saturation = 86% on room air). His ChemstripTM and temperature were recorded as 4.1 and 37.2°C respectively. The patient was intubated without facilitation, and resuscitated with IV fluids. At this time, pupils were 4 mm and reactive, there were no needle tracks suggesting recent IV drug use, and there was an odour on his breath of some indeterminate volatile compound. He was hypotonic, but otherwise the exam was noncontributory. Venous and arterial samples were obtained for repeat analyses, and results of the ECG were normal except for sinus tachycardia. Specifically, QRS and QT intervals were normal with unremarkable AVR morphology. Computed tomography of the head demonstrated no acute pathology.

The 0220 h laboratory results were as follows.

- Serum electrolytes: Na⁺ = 147 (133–146) mmol/L, K⁺ = 3.4 (3.5–5.0) mmol/L, Cl⁻ = 114 (96–107) mmol/L, total CO₂ = 21 (23–31) mmol/L, urea nitrogen = 1.4 (2.5–8.0)

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- mmol/L urea, glucose = 5.9 (3.3–11.0) mmol/L
- Anion gap = 12 (4–16)
- Measured serum osmolality = 447 (280–300) mmol/kg; calculated osmolality = 301 mmol/kg; osmolar gap = 146 (<10) mmol/L, ethanol = 136 mmol/L, unaccounted osmolar gap = 10 mmol/kg
- Toxicology screen negative for acetylsalicylic acid, acetaminophen and barbiturates

The clinical presentation was consistent with acute ethanol ingestion, but the patient had been in the ED under the care of our team during the 4 hours between the 2 sets of lab tests. The area around the patient was searched and yielded no evidence of empty bottles. Moreover, there was no sign of “smuggled” containers anywhere in the ED, or outside in the adjacent waiting area, or in rest areas outside of the department. The only medicinal ethanol in the department was in the form of pharmaceutical 10% v/v ethanol. The patient had had no visitors during his stay, and nearby patients had not engaged in any suspicious activity.

After an exhaustive search for the source of alcohol, the answer to the mystery was “elementary” indeed. The attending physician noted, as he was washing his hands with a hand sanitizer after re-examining the patient, that the hand sanitizer contained a high concentration of ethyl alcohol. Apparently, the patient had ingested all 3 bottles of Microsan™ Antiseptic Instant Hand Sanitizer (DEB Canada, Waterford, Ont.) (Fig. 1) that were stored within reach of his stretcher. These units are deployed strategically throughout the department to facilitate good hand-washing practice in our ED. Each pump-action container holds 500 mL of 70% ethyl alcohol, and the patient’s im-



Fig. 1. Microsan™ Antiseptic Instant Hand Sanitizer

pressive, or perhaps instinctive, understanding of organic chemistry led him to a handy source of ethanol. If the containers were full, this would equate to an ingestion of approximately 44 pints of St. Patrick’s day beer over a 4-hour period!

The patient was extubated 12 hours later and admitted to hospital for further supportive therapy and counselling. Four days later, on an inpatient ward and under constant supervision by a security guard, the patient managed to ingest 2 more containers of Microsan™, achieving an alcohol level of 82 mmol/L. His was ultimately discharged, received outpatient counselling and continues to present to the ED at varying intervals for ongoing substance abuse.

The local substance-abuse population is now very aware of Microsan™, and consequently these devices are under more stringent control.

Discussion

It is not uncommon for alcohol abusers to ingest smuggled alcohol after their arrival in the ED despite staff’s best attempts to prevent this. Premixed juice containers with spir-its, unlabelled medicine bottles, or the old “bottle in a brown bag” are common strategies. We have also treated patients who purposely ingest methanol or ethylene glycol — knowing that an ethanol drip or oral ethanol will likely be started. This case illustrates a novel source of ethanol and an innovative ingestion method. We performed a structured review of MEDLINE, EMBASE, and PubMed using the MeSH search terms “ethanol,” “ethyl alcohol,” “Microsan” and “hand sanitizer,” linked with the prognostic search hedges of “prognosis.mp.or survival analysis.sh.” We also searched the Cochrane Database of Systematic Reviews using a similar search strategy. These searches uncovered no previous reports of Microsan™ hand sanitizer ingestion.

Ethanol-dependent patients in the ED are a heterogeneous group. They may be young or old, intoxicated or withdrawing, acute or chronic; and they may have pure alcohol ingestion or mixed ingestion. In addition, they are prone to associated traumatic, toxicological and medical problems; therefore, although alcohol levels are readily available in the ED, acute alcohol intoxication remains largely a diagnosis of exclusion.

Blood ethanol levels are of limited value when alcohol intoxication is clinically apparent; however, when the clinical presentation is unclear, a high ethanol level may provide the diagnosis and a low level may direct the physician toward more dangerous diagnoses (e.g., other intoxications, CNS lesions or metabolic disorders). Susceptibility to ethanol

Table 1. Physiologic effects and blood alcohol concentration (BAC) levels

mmol/L*	Effect†	BAC (mg/dL)	BAC (mg%)
4–11	Decreased fine motor control	20–50	0.02–0.05
11–22	Decreased coordination	50–100	0.05–0.10
22–33	Difficulty standing	100–150	0.10–0.15
33–55	Difficulty sitting	150–250	0.15–0.25
66	Unresponsive to voice and/or pain	300	0.30
88	Respiratory depression	400	0.40

* 4.6 mmol = mg/dL conversion factor

† Varies from patient to patient

Adapted, with the permission of the publisher, from *Emergency Medicine: Concepts and Clinical Practice*, 4th ed., 1998, Mosby, New York.¹

may vary profoundly between individuals, but Table 1 summarizes approximate expected incremental neurological effects of ethanol based on the 3 reporting methods.

Conclusions

This case highlights 3 critical points. Medical conditions can change or evolve during the span of an ED visit. When the clinical status changes unexpectedly, it is often necessary to start from the beginning and re-evaluate the patient, in many cases repeating the history, physical, and relevant diagnostic tests. Finally, physicians and nurses should be

aware of potential toxins that are right under their noses — or in this case, on their hands.

Competing interests: None declared.

Reference

1. McMicken DB. Alcohol-related disease. In: Rosen P, Barkin R, editors. *Emergency medicine: concepts and clinical practice*. 4th ed. New York: Mosby; 1998. p. 1265.

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