



Selected Topics: Toxicology

REVERSIBLE NEUROTOXICITY DUE TO EXCESSIVE USE OF ETHYL CHLORIDE

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Abstract—Background: Ethyl chloride is commercially available as a DVD/VCR cleaner, and can be found as a gasoline additive and topical anesthetic. There is an emerging trend of recreational huffing to enhance sexual relations. Neurotoxicity from repeated abuse is uncommon. **Case Report:** A 36-year-old man with a history of intermittent ethyl chloride use for 15 years presented to the Emergency Department with an inability to walk for 4 days after frequent use for 1 week. The patient reported a rapid titration of inhalation from zero to eight cans of 4.6 oz ethyl chloride aerosol per day over a 1-week period. Initial vital signs were heart rate 88 beats/min, blood pressure 147/60 mm Hg, temperature 37.2°C (99°F), and respiratory rate 16 breaths/min. Physical examination was notable for slurred speech, ptosis, a wide-based and ataxic gait with short strides, inability to stand without support, loss of toe/finger proprioception, horizontal and vertical nystagmus, and dysmetria on coordination testing. Strength and sensation were preserved. His work-up included computed tomography and magnetic resonance imaging of the brain, cervical, thoracic, and lumbar spine that demonstrated no acute abnormalities. On hospital day 9, the patient was able to ambulate with mild difficulty. **Discussion:** Toxicity from excessive ethyl chloride huffing has been rarely reported. The toxicity was characterized with cerebellar findings, no attributable laboratory abnormalities, and no radiographic abnormalities on computed tomography/magnetic resonance imaging. The neurotoxicity resolved with supportive care. Why

Should an Emergency Physician Be Aware of This? This case of excessive huffing of ethyl chloride presenting with neurotoxicity and ataxia further characterizes a rare complication of ethyl chloride toxicity that is gaining popularity. © 2022 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Keywords—ethyl chloride; poppers; neurotoxicity; ataxia; huffing; ragging; LGBT; MSM

INTRODUCTION

Ethyl chloride is a colorless, volatile liquid that was previously used as a general anesthetic and is currently used as a topical anesthetic (1). Ethyl chloride is also commercially available as a DVD/VCR head cleaner or topical anesthetic, and it is easy to purchase online. There is an emerging trend of recreational use for sexual enhancement within the men-who-have-sex-with-men (MSM) community, like the use of alkylated nitrites (“poppers”) (2–4).

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CASE REPORT

13
14 A 36-year-old human immunodeficiency virus-negative,
15 homosexual man with history of intermittent ethyl chloro-
16 ride huffing for 15 years presented to the Emergency
17 Department (ED) with an inability to walk for 4 days
18 after more frequent daily use for 1 week leading up to
19 presentation. The patient reported a rapid titration of “rag-
20 ging” from zero to eight 4.6-oz ethyl chloride aerosol
21 cans per day over a 1-week period. The patient used
22 the brands Maximum Impact® (Lake Worth, Florida)
23 and Amsterdam® obtained from local adult entertainment
24 stores (Fig. 1). He denied use of supplements or prescrip-
25 tion medications. He recreationally used marijuana but
26 denied other inhalant or drug use. He denied use of ni-
27 trous oxide. He ceased using ethyl chloride 3 days prior
28 to presentation.

29 A similar episode of ataxia occurred 1 month prior
30 after a similar episode of heavy ethyl chloride use, and
31 symptoms resolved over 2 weeks. He reported a nega-
32 tive magnetic resonance imaging (MRI) scan of the brain
33 during that evaluation, but the records were unobtain-
34 able. The patient was abstinent from ethyl chloride use
35 from prior symptom resolution until this recent binge.
36 Initial vital signs were heart rate 88 beats/min, blood
37 pressure 147/60 mm Hg, temperature 37.2°C (99°F),
38 and respiratory rate 16 breaths/min. Physical examina-
39 tion was notable for slurred speech, ptosis, a wide-based
40 and ataxic gait with short strides, inability to stand with-
41 out support, loss of toe/finger proprioception, horizontal
42 and vertical nystagmus, bilateral finger-to-nose dysme-
43 tria, bilateral mild heel-to-shin dysmetria, and normal
44 strength and sensation. Laboratory data were notable for
45 serum bicarbonate of 20 mmol/L, creatinine 1.21 mg/dL,
46 and alkaline phosphatase 35 U/L. Otherwise, laboratory
47 data were normal; other pertinent labs are summarized
48 in Table 1. Computed tomography of the brain and MRI
49 of the brain, cervical, thoracic, and lumbar spine were
50 performed to rule out other pathology such as demyeli-
51 nating disease and demonstrated no acute abnormalities.
52 Due to the lack of other etiologies being found and his
53 history of ethyl chloride abuse previously with similar
54 symptoms that improved with cessation, this diagnosis
55 seemed the most likely. Further laboratory data were ob-
56 tained to rule out other possible volatile hydrocarbons,
57 vitamin deficiency, and nitrous oxide as the etiology of
58 his presentation (Table 1). He initially had minimal im-
59 provement of his symptoms after admission; however, on
60 symptom day 9 he dramatically improved and was able
61 to ambulate with mild difficulty when using a cane. On
62 2-week follow-up after discharge, he reported minimal
63 difficulty ambulating with a cane and denied any further
64 ethyl chloride abuse. He had no other neurologic symp-
65 toms or complaints. Incidentally, the patient was observed



Figure 1. Maximum Impact can of ethyl chloride.
Photo Credit: G. Winkler.

walking normally at a local grocery store 221 days after discharge.

Ethyl chloride (chloroethane, C_2H_5Cl) is a volatile aliphatic, halogenated hydrocarbon with a pungent ether-like smell. It is noted to be highly lipophilic and is rapidly absorbed by the lungs. Previously, it was used as a general anesthetic, but fell out of favor once safer anesthetics became available. Ethyl chloride is still used in modern medical practice as a topical anesthetic prior to orthopedic

Table 1. Pertinent Labs During Hospitalization

Test	Laboratory Value	Reference Range	Diagnostic Test for:
Thiamine, whole blood	134 nmol/L	70–180 nmol/L	Alcohol abuse
Vitamin B12, plasma	427 pg/mL	232–1245 pg/mL	Nitrous oxide abuse (B12 deficiency)
Homocysteine, total-blood	9 umol/L	0–14 umol/L	Nitrous oxide abuse (B12 deficiency)
Methylmalonic acid, serum	0.17 umol/L	0.00–0.40 umol/L	Nitrous oxide abuse (B12 deficiency)
Hippuric acid, urine	1.6 g/L	Normal for unexposed populations is ≤ 1.6 g/L	Toluene abuse
Hippuric acid/creatinine ratio	0.61 g/g	Normal for unexposed populations is < 1.5 g/g	Toluene abuse
Methylhippuric acid, urine	Not detected	Not detected in nonexposed general population	Xylene abuse

75 joint injections because evaporation from the skin pro-
 76 duces a rapid cooling sensation (1). It can also be used
 77 for analgesia after injury in Sports Medicine or prior to
 78 ear piercing.

79 Ethyl chloride acts as a central nervous system de-
 80 pressant. Symptoms after exposure include lightheaded-
 81 ness, euphoria, elation, slurred speech, auditory and visual
 82 hallucinations, and confusion (1). Cardiac dysrhythmias
 83 can occur with heavy ethyl chloride use as with other
 84 halogenated hydrocarbons. In recent years ethyl chlo-
 85 ride has gained popularity as a sexual aide stimulant
 86 within the MSM community (2–4). Reportedly, the use
 87 is popular within the MSM community due to its anes-
 88 thetic effect during sex (4). Ethyl chloride is “ragged,”
 89 unlike traditional poppers (alkylated nitrites) where the
 90 fumes are directly inhaled from the bottle. Ethyl chlo-
 91 ride is commercially available in stores and online as
 92 DVD/VCR head cleaner and topical anesthetic. Com-
 93 mon brand names include Maximum Impact, Amsterdam,
 94 Rush, and Jungle Juice (Fig. 1) (1,2). Ethyl chloride is
 95 eliminated unchanged through respiration and is hepatic-
 96 ally metabolized by both the cytochrome P450 system
 97 and glutathione-S-transferase-dependent conjugation in
 98 rodents. Human metabolism and elimination is not well
 99 understood. Ethyl chloride can be measured by blood test-
 100 ing through gas chromatography/mass spectrometry, thus,

ethyl testing is impractical, difficult, and not easily acces-
 sible (1,5).

Neurotoxicity and death from ethyl chloride use has
 been reported after heavy use, although the pathophys-
 iology is poorly understood (1,5–9). Recreational use
 produces sexual stimulation, disinhibition, increased sex-
 ual arousal and pleasure, a euphoric rush, and feelings of
 drunkenness (1,6). Further symptoms include central ner-
 vous system depression, respiratory depression, altered
 mental status, cardiac depression, cardiac dysrhythmias,
 and inability to walk or stand (1,6–12). Prolonged peri-
 ods of toxicity exhibited by ataxia, unsteadiness, slurred
 speech, central nervous system depression, and abnormal
 gait have been reported (6,11–13). The toxicity in this case
 is similar to prior reports and was characterized by cere-
 bellar findings without attributable laboratory abnormal-
 ities or radiographic abnormalities on CT/MRI (6,8,12).
 The patient had a slow and prolonged recovery, most
 likely attributable to the significant central nervous sys-
 tem distribution and high lipophilicity. Treatment for ethyl
 chloride toxicity is supportive; there are no methods to
 enhance elimination or antidotes. Patients should be mon-
 itored for hypoxia, cardiac dysrhythmias, and electrolyte
 abnormalities. This patient’s neurotoxicity was subacute
 and spontaneously resolved with supportive care. Interest-
 ingly, this case also represents an exposure, re-exposure
 for toxicity after repeated heavy abuse.

128 **WHY SHOULD AN EMERGENCY PHYSICIAN**
129 **BE AWARE OF THIS?**

130 Ethyl chloride is widely available, easily obtained, and is
131 used as a sexual enhancement drug and a drug of abuse
132 (2). Given the increasing use of this inhalant, clinicians
133 should be aware that excessive inhalation of ethyl chlo-
134 ride may result in subacute, reversible neurotoxicity with
135 normal imaging.

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