

Ethyl Chloride Neurotoxicity Following Abuse

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Case Summary:

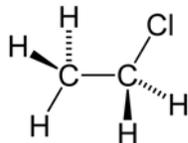
A 45 year-old Caucasian man with a history of HIV presents to the Emergency Department with chief complaint of “feeling off balance.” His symptoms started the day before, after he inhaled several canisters of a video recorder head cleaner. The patient states that he sprayed approximately 8 canisters into a cloth and inhaled it (huffed) in the morning, followed by 10 canisters at night. After inhalation, patient felt off-balance, and had difficulty writing and slurred speech. Although these symptoms disappeared after the morning inhalation, they persisted after re-dosing at night. He presented to the ED the next morning after falling.

The patient was admitted to the hospital one month earlier with similar complaints after using more canisters than usual. He had a normal neurologic work-up as an inpatient with an unremarkable brain MRI and has been following up with a neurologist as an outpatient.

Upon initial physical examination, he was alert and oriented. Vital signs were: blood pressure, 112/57 mmHg; heart rate, 88 beats/minute; respiratory rate, 18 breaths/minute; and temperature, 96.5° F. His neurologic examination was significant for 4/5 strength in bilateral hip flexors and extensors, knee flexors and extensors, as well as foot flexor and extensor muscle groups. His bilateral lower extremities were hyperreflexic. Finger-to-nose testing was intact but the heel-to-shin maneuver was abnormal, and he had a positive Romberg test. He had pronounced ataxia requiring walker and gait spasticity. The speech was slightly slurred, though it was comprehensible. The patient had difficulty writing.

Initial laboratory results including basic metabolic panel, complete blood count, and urinalysis were normal. An electrocardiogram showed sinus rhythm with a normal QRS and QTc intervals. CT brain without contrast was normal.

What chemical did the patient inhale?



The patient inhaled ethyl chloride or chloroethane. This is a colorless, volatile gas with an unpleasant odor. Ethyl chloride is used as a topical anesthetic, propellant in aerosol canisters, refrigerant, and as an alkylating agent. Throughout the 20th Century, it was used to produce tetraethyl lead (TEL), a gasoline additive that is no longer used. It finds industrial use to convert cellulose to ethylcellulose, and as a thickening agent and binder in paint and cosmetics.

Ethyl chloride is a recreational inhalant drug. It is usually huffed or sprayed into a cloth and inhaled, particularly to enhance the sexual experience. It is sold on Web sites and in specialty stores, and easily purchased as products such as “Maximum Impact” VCR head cleaning solvent and “Black Jac” video head cleaner.

What are the signs and symptoms of ethyl chloride toxicity?

Ethyl chloride is sedating, and was used previously in general anesthesia, though this practice was discontinued due to high incidence of dysrhythmias. Sensitization of the cardiac muscle to catecholamines, stimulation of the vagus nerve, and direct myocardial depression may account for dysrhythmia formation.

Knowledge about ethyl chloride-associated neurotoxicity is limited, and is primarily derived from case reports. Patients suffer from ataxia, dizziness, and bilateral lower extremity motor, and occasionally sensory, neuropathy. Patients occasionally report olfactory and visual hallucinations shortly following ethyl chloride huffing.

Previous reports include:

A 41 year-old man presented with drowsiness, shakiness and inability to walk due impaired balance. On exam, the patient was tremulous, dysarthric, weak and ataxic. After a normal neurological and infectious work-up, the patient admitted that he has been inhaling the VCR head cleaner “Maximum Impact” and felt similar symptoms after heavy use. His symptoms, with the exception of tremor, resolved in 5 days.¹

A 22 year-old man presented with ataxia, blurring of vision, and diplopia associated with ataxia, horizontal nystagmus, inability to perform heel-to-shin maneuver, and a positive Romberg. The patient later admitted to inhalation of ethyl chloride. His symptoms resolved in 7 days.²

A 52 year-old man presented with confusion, disorientation, visual hallucinations, and ataxia. This case was complicated by a history of alcohol and barbiturate abuse. The patient had a generalized seizure while hospitalized. He reported a 30-year history of sniffing ethyl chloride, with increased usage 4 months prior to the admission. He described euphoria, olfactory and visual hallucinations. On neurologic evaluation, the patient had impaired vibration sense in bilateral lower extremities with diffuse moderate neuropathy of both motor and sensory neurons. He was discharged from the hospital 6 weeks following the admission.³

There are a few case reports of death with ethyl chloride inhalation:

A young, otherwise healthy college student was found face down in his pillow at home with a bottle of “Maximum Impact” (containing ethyl chloride) canister in his hand. He could not be revived despite extensive resuscitative effort. Qualitative postmortem testing detected ethyl chloride.⁴

A 30 year-old man deceased man was found surrounded by four cans of “Black Jac” VCR tape head cleaner along with a rag held loosely in his mouth. Ethyl chloride was detectable postmortem in his body fluids.⁵

What is the mechanism of ethyl chloride neurotoxicity?

Ethyl chloride is a halogenated hydrocarbon, and presumably has a mechanism of action and toxicity similar to the entire class of xenobiotics. Their high lipophilicity provides easy access to the central nervous system, where they produce global neuronal dysfunction through diverse and poorly understood means. Persistent dysfunction due to extensive exposure (as in abuse) may lead to compensatory, and slow to reverse, changes in the neuron.

What is the disposition for the patient who presents to the Emergency Department after inhaling or huffing ethyl chloride?

From the few case reports, ethyl chloride neurotoxicity may persist for several days. It is prudent to perform a thorough neurological investigation and exclude other etiologies for the persistent neurologic findings. The patient should have an EKG since acute inhalation of ethyl chloride may lead to arrhythmia.

Case Conclusion:

The patient was admitted to the hospital and underwent evaluation for metabolic (e.g., vitamin deficiencies) and neurologic causes. MRI of the cervical, thoracic and lumbar spine were normal. Brain MRI, performed one month earlier, was not repeated. His ataxia, slurred speech, and difficulty writing improved steadily and he was discharged after 5 days of hospitalization to follow-up with his neurologist.

Conclusions:

Ethyl chloride is a recreational drug of abuse and can be easily obtained on various Web sites and specialty shops. Cerebellar and peripheral motor neuron components to the ethyl chloride toxicity include ataxia, bilateral lower extremity weakness with hyperreflexia. The mechanism of action of ethyl chloride is unknown. Patients with ethyl chloride-associated neurotoxicity should undergo full medical and neurological evaluation.

Bibliography

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