

Serious complications due to ‘huffing’

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Ms. G, age 32, has bipolar disorder, anxiety, and inhalant use disorder. She is brought to the ED after being found unresponsive in a public restroom. Is it aerosol abuse, or something more?



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CASE A relapse and crisis

Ms. G, age 32, is brought to the emergency department (ED) by police after being found in a stupor-like state in a public restroom. The consultation-liaison (CL) psychiatry team assesses her for concerns of self-harm and suicide behavior. Ms. G discloses that she “huffs” an average of 4 canisters of air dusters daily to cope with psychosocial stressors and achieve a euphoric state. She recently lost her job, which led to homelessness, financial difficulties, a relapse to aerosol use after 2 years of abstinence, and stealing aerosol cans. The latest incident follows 2 prior arrests, which led officers to bring her to the ED for medical evaluation. Ms. G has a history of bipolar disorder (BD), generalized anxiety disorder (GAD), insomnia, and inhalant use disorder.

HISTORY Inhalant abuse and suicide attempt

Ms. G reports a longstanding history of severe inhalant abuse, primarily with air dusters due to their accessibility and low cost. She previously underwent inpatient rehab for inhalant abuse, and received inpatient psychiatry treatment 5 years ago for a suicide attempt by overdose linked to psychosocial stressors. In addition to BD, GAD, insomnia, and inhalant use disorder, Ms. G has a history of neuropathy,

seizures, and recurrent hypokalemia. She is single and does not have insurance.

Which of the following most likely contributed to Ms. G’s stupor-like state?

- Overdose of a benzodiazepine prescribed for GAD
- Alcohol intoxication due to psychosocial stressors
- Metabolic abnormality in the context of chronic hyperkalemia
- Intoxication from an inhalant
- Manic episode in the context of BD

The authors’ observations

Inhalant abuse is the intentional inhalation of volatile substances to achieve an altered mental state. Inhalants are commercially available products that can produce intoxication if inhaled, such as glue,

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Table 1

Types of inhalants and associated terminology

	Volatile solvents	Aerosols
Description	Liquids vaporizing at room temperature	Sprays containing solvents and propellants
Products	Art and office supplies: correction fluid, felt-tip markers, glue Household chemicals: paint thinner/remover, gasoline, lighter fluid, rubber cement	Household chemicals: spray paint, hairspray, vegetable oil sprays, deodorant sprays, computer dusting sprays
Associated terms	Chroming, gluey, snotballs	Air blast, dusting, spray
General terms	Bullet bolt, highball, hippie crack, medusa, oz, poor man's pot, satan's secret, Texas shoe polish, toilet water	

Source: Adapted from reference 1

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Easy access and low cost make inhalant use a popular form of substance abuse among adolescents

toluene, spray paint, gasoline, and lighter fluid (*Table 1*).

The epidemiology of inhalant abuse is difficult to accurately report due to a lack of recognition and social stigma. Due to inhalants' ease of access and low cost, this form of substance abuse is popular among adolescents, adults of low socioeconomic status, individuals who live in rural areas, and those living in institutions. Inhalants act as reinforcers, producing a euphoric state. Rapid pulmonary absorption and lipid solubility of the substance rapidly alters the brain. Inhalant abuse can result in chemical and thermal burns, withdrawal symptoms, persistent mental illness, and catastrophic medical emergencies such as ventricular arrhythmias leading to disruptive myocardial electrical propagation. Chronic abuse can cause irreversible neurological and neuropsychological effects, cardiomyopathy, rapid airway compromise, pulmonary debilitations, renal tubular acidosis, bone marrow toxicity, reduced immunity, and peripheral neuropathy.²

Ms. G's diagnosis of inhalant use disorder was based on her mental state and history of severe inhalant misuse, specifically with air dusters. Several additional factors further support this diagnosis, including the fact she survived a suicide attempt by overdose 5 years ago, had an inpatient rehabilitation placement for inhalant abuse,

experiences insomnia, and was attempting to self-treat a depressive episode relapse with inhalants.

EVALUATION Depressed but cooperative

After being monitored in the ED for several hours, Ms. G is no longer in a stupor-like state. She has poor body habitus, appears older than her stated age, and is unkempt in appearance/attire. She is mildly distressed but relatively cooperative and engaged during the interview. Ms. G has a depressed mood and is anxious, with mood-congruent affect, and is tearful at times, especially when discussing recent stressors. She denies suicidality, homicidality, paranoia, delusions, and hallucinations. Her thought process is linear, goal-directed, and logical. She has fair insight, but relatively poor and impulsive judgment. The nursing staff expresses concerns that Ms. G was possibly responding to internal stimuli and behaving bizarrely during her initial presentation; this was not evident upon examination.

Ms. G reports having acute-on-chronic headaches, intermittent myalgias and weakness in her lower extremities (acute), and polyneuropathy (chronic). She denies a history of manic episodes or psychosis but reports previous relative hypomanic epi-



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Gases	Nitrates
Gases found in medical anesthetics and in household or commercial products	Volatiles found in medical settings and as household chemicals
Medical anesthetics: ether, nitrous oxide Household/commercial chemicals: propane tanks, butane lighters, whipped cream aerosols, refrigerant gases	Medical supplies: amyl nitrates, butyl Household chemicals: room deodorizers
Whippets, capping, buzz bomb, laughing gas, shoot the breeze	Poppers, boopers, glading, pearls

sodes that vacillated with periods of recurrent depressive episodes. Ms. G denies using illicit substances other than tobacco and inhalants. She says she had adhered to her outpatient psychiatric management services and medication regimen (duloxetine 60 mg/d at bedtime for mood/migraines, trazodone 150 mg/d at bedtime for insomnia, ziprasidone 40 mg/d at bedtime for BD, carbamazepine 200 mg twice daily for neuropathy/migraines, gabapentin 400 mg 3 times daily for neuropathy migraines/anxiety, and propranolol 10 mg 3 times daily for anxiety/tremors/migraine prophylaxis) until 4 days before her current presentation to the ED, when she used inhalants and was arrested.

Ms. G's vitals are mostly unremarkable, but her heart rate is 116 beats per minute. There are no acute findings on physical examination. She is not pregnant, and her creatinine, glomerular filtration rate, complete blood count, and thyroid-stimulating hormone are all within normal limits. Her blood sugar is high (120 mg/dL; reference range 70 to 100 mg/dL). She has slight transaminitis with high aspartate aminotransferase (93 U/L; reference range 17 to 59 U/L) and high alanine aminotransferase (69 U/L; reference range 20 to 35 U/L); chronic hypokalemia (2.4 mmol/L; reference range 3.5 to 5.2 mmol/L), which leads the primary team to initiate a potassium replacement protocol; lactic acidosis

(2.2 mmol/L; normal levels <2 mmol/L); and creatine kinase (CK) 5,930 U/L.

Which is a likely complication of Ms. G's inhalant abuse?

- Myocardial infarction
- Rhabdomyolysis
- Peripheral neuropathy
- Glomerulonephritis
- Aplastic anemia

The authors' observations

Efforts to improve the laboratory diagnosis of inhalant abuse are ongoing, but they have not yet been widely implemented. Systemic screening and assessment of inhalant use can help prevent and treat complications. For Ms. G, we considered several possible complications, including hypoglycemia. Although the classic triad of myalgia, weakness, and myoglobinuria (tea-colored urine) was not present, elevated CK levels in the context of Ms. G's intermittent myalgia and lower extremity weakness led us to suspect she was experiencing moderate rhabdomyolysis (*Table 2*,³ *page 44*).

Rhabdomyolysis can be caused by several factors, including drug abuse, trauma, neuromuscular syndrome, and immobility. Treatment is mainly supportive, with a focus on preserving the ABCs (airway,

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Inhalant abuse can result in persistent mental illness and catastrophic medical emergencies

Table 2

Classification of rhabdomyolysis based on creatine kinase level

Diagnosis	CK level	Clinical significance	Treatment needed
Normal	40 to 200 U/L	NA	NA
Mild rhabdomyolysis	1,000 to 5,000 U/L	Low risk for kidney injury	Possibly, depending on context
Moderate rhabdomyolysis	5,000 to 15,000 U/L	Increased risk of renal injury	Yes
Severe rhabdomyolysis	>15,000 U/L	Increased risk for dialysis	Yes, emergent

CK: creatine kinase; NA: not applicable
Source: Reference 3

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Supportive care and vigilant monitoring are the only options for treating inhalant intoxication or withdrawal

breathing, circulation) and renal function through vigorous rehydration.⁴ We postulated Ms. G’s rhabdomyolysis was caused by muscle damage directly resulting from inhalant abuse and compounded by her remaining in prolonged fixed position on the ground after overdosing on inhalants.

TREATMENT Rehydration and psychotropics

The treatment team initiates IV fluid hydration of chloride 0.9% 150 mL/h and monitors Ms. G until she is stable and the trajectory of her CK levels begins to decline. On hospital Day 2, Ms. G’s CK decreases to 2,475 U/L and her lactic acid levels normalize. Ms. G restarts her regimen of duloxetine 60 mg/d, trazodone 150 mg/d, ziprasidone 40 mg/d, carbamazepine 200 mg twice daily, gabapentin 400 mg 3 times daily, and propranolol 10 mg 3 times daily. The team adds quetiapine 25 mg as needed for hallucinations, paranoia, and/or anxiety. Ms. G is closely monitored due to the potential risk of toxicity-induced or withdrawal-induced psychotic symptoms.

Which of the following has the greatest impact on preventing complications due to inhalant abuse?

- a) IV fluids and rehydration
- b) Ziprasidone 40 mg
- c) Propranolol 10 mg
- d) Carbamazepine 200 mg
- e) Psychosocial education and counseling

The authors’ observations

Presently, there are no effective treatments for acute inhalant intoxication or withdrawal, which makes supportive care and vigilant monitoring the only options.⁵ Although clinical research has not led to any FDA-approved treatments for chronic inhalant use disorder, a multipronged biopsychosocial treatment approach is critical in light of the negative consequences of inhalant abuse, including poor academic performance, criminal behavior, abuse of other substances, social maladjustment, low self-esteem, and suicidality.⁶

Ms. G had a moderate form of rhabdomyolysis, which was managed with IV fluid rehydration. Education and counseling were crucial to help Ms. G understand the unintended complications and potentially life-threatening consequences of inhalant abuse, with rehabilitation services to encourage abstinence. Ms. G had previously undergone successful inpatient rehabilitation and was willing to start such services again. She reported success with gabapentin for her polyneuropathy and migraines, which may be long-term consequences of prolonged inhalant abuse with neurological lesions. Ziprasidone may have mitigated some of the impulsivity and hypomanic symptoms of her BD that could make her more likely to engage in risky self-harm behaviors.

After extensive discussion on the long-term complications of inhalant abuse, Ms. G

was motivated, cooperative, and sought care to return to rehabilitation services. The CL psychiatry team collaborated with the social work team to address the psychosocial components of Ms. G's homelessness and facilitated an application for a local resource to obtain rehabilitation placement and living assistance. Her years of abstinence from inhalant use and success with rehabilitation demonstrate the need for a multimodal approach to manage and treat inhalant use disorder. Outpatient follow-up arrangements were made with local mental health resources.

OUTCOME Improved outlook and discharge

Ms. G reports improved mood and willingness to change her substance use habits. The treatment team counsels her on the acute risk of fatal arrhythmias and end-organ complications of inhalant abuse. They warn her about the potential long-term effects of mood alterations, neurological lesions, and polyneuropathy that could possibly worsen with substance abuse. Ms. G expresses appreciation for this counseling, the help associated with her aftercare, and the referral to restart the 30-day inpatient rehabilitation services. The team arranges follow-up with outpatient psychiatry

Related Resources

- Gude J, Bisen V, Fujii K. Medication-induced rhabdomyolysis. *Current Psychiatry*. 2023;22(2):39-40. doi:10.12788/cp.0332
- Waldman W, Kabata PM, Dines AM, et al. Rhabdomyolysis related to acute recreational drug toxicity—a Euro-DEN study. *PLoS One*. 2021;16(3):e0246297. doi:10.1371/journal.pone.0246297

Drug Brand Names

Carbamazepine • Tegretol	Quetiapine • Seroquel
Duloxetine • Cymbalta	Trazodone • Olepro
Gabapentin • Neurontin	Ziprasidone • Geodon
Propranolol • Inderal	

and outpatient therapy services to enhance Ms. G's coping skills and mitigate her reliance on inhalants to regulate her mood.

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Educate patients who abuse inhalants on the unintended complications and potentially life-threatening consequences

Bottom Line

Inhalant use is a poorly understood form of substance abuse that disproportionately affects vulnerable populations. It can lead to life-threatening medical emergencies such as rhabdomyolysis. Clinicians need to be able to identify and manage inhalant abuse and associated complications, as well as provide appropriate education and counseling to prevent further misuse.