

증례

질소 가스를 사용한 자살 시도 1례: 증례보고

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Attempted Suicide by Nitrogen Gas Asphyxiation: A Case Report

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Nitrogen is an inert gas that is harmless to humans under normal conditions. While it is not inherently toxic, nitrogen gas becomes dangerous when it displaces oxygen, resulting in suffocation. Herein, we report a case of a 34-year-old man who attempted suicide by nitrogen asphyxiation who presenting with decreased mental function and agitation. Lactic acidosis and hyperammonemia were observed on presentation at the emergency department, but these improved after a few hours. After 2 days, the patient regained full consciousness, and was discharged without any complications. Survival after asphyxiation due to nitrogen gas is very rare, and these patients are more likely to have poorer outcomes. There is a potential for the increasing use of nitrogen gas as a method of committing suicide because of the ease of access to this gas.

Key Words: Nitrogen, Asphyxia, Suicide, Gas poisoning

Introduction

Atmospheric air is composed primarily of nitrogen gas, accounting for 78% of the atmosphere. In its standard state, nitrogen is colorless, odorless, tasteless, and inert gas¹⁾. Nitrogen gas is generally regarded as harmless; however, it can be an asphyxiant such as the gases, methane, propane, and carbon dioxide²⁾. Several nitrogen-related deaths have been reported in scuba diving accidents, laboratories,

anesthetic accidents, and suicide attempts³⁻⁶⁾. There are however, very few reports of patients surviving after nitrogen gas asphyxiation. Here, we report the case of patient who survived without complications after attempting suicide using nitrogen gas.

Case Report

A 34-year-old man presented to the emergency department with decreased mental function. One hour before arrival at the emergency department, the passenger reported that someone is shouting in the car. When 119 paramedics arrived, the door of the car was locked and the patient was shouting. The paramedic crashed the car window and rescued the patient, and a nitrogen gas cylinder was found in the car (Fig. 1). It took 10 minutes from report to arrival.

At presentation in emergency room, he was con-

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fused with a Glasgow Coma Scale of E4V3M5. Both fully dilated pupils were observed and light reflex was intact. He yelled loudly and did not obey commands. His initial vital signs were as follows: blood pressure: 140/80 mmHg, heart rate: 155 beats/minute, respiratory rate: 30 breaths/minute, temperature: 36.8°C, and oxygen saturation measured using pulse oximetry: 96% with room air. Electrocardiogram showed marked sinus tachycardia without any ST segment changes, while computed tomographic scans of brain did not show any structural abnormalities. Initial laboratory tests revealed mild rhabdomyolysis (creatinine kinase: 227.8 U/L, and myoglobin: 152.5 ng/mL), and hyperammonemia (ammonia: 144 μ g/dL). Initial arterial blood gas analysis showed metabolic acidosis (pH: 7.27, PCO₂: 26.8, PO₂: 94.6, HCO₃⁻: 12.5) with increased lactic acid (14.1 mmol/L). Methemoglobin (0.2%) and carboxyhemoglobin (0.5%) were within normal ranges, and serum ethanol was 0.6 mg/dL. Neuron-specific enolase was 33.14 ng/mL (normal range: 0-16.3 ng/mL). We administered intravenous lorazepam and haloperidol for his severe agi-



Fig. 1. Nitrogen gas cylinder found in car.

tation, and then started high flow oxygen via non-rebreather face mask. After 3 hours, acidosis was normalized (pH: 7.36, PCO₂: 38.5, PO₂: 316.8, HCO₃⁻: 22.1, lactic acid: 0.9 mmol/L). Hyperammonemia also improved without lactulose enema. Thereafter, the patient was admitted to the intensive care unit, wherein, on the following day, his consciousness improved, although he could not remember the doctor's face, and repeatedly asked which day of the week it was, and why he was there. Two days after admission, his consciousness had recovered fully. He had an economic problem and decided to commit suicide. He easily gained information through various suicide internet sites. He was informed that the method of suicide using nitrogen gas was painless, easy to obtain, and had a high success rates. He bought the nitrogen gas cylinder through the web shopping site without difficulty. According to the information on the site, he put a plastic bag on his head. Then, gas was injected into the bag using a rubber hose. After that, he lost consciousness and restored his consciousness today Five days after admission, he was discharged without any complications.

Discussion

Death due to nitrogen gas poisoning was reported occasionally. However, reports of survivors after nitrogen gas poisoning are very rare. Our case showed the clinical course of patient with nitrogen gas asphyxiation. It included lactic acidosis, hyperammonemia, delirium, rhabdomyolysis.

Asphyxia is defined as the absence, or lack of oxygen exchange, and can be divided into three categories: suffocation, strangulation and chemical asphyxiation^{5,6}. Nitrogen is an asphyxiant, and can cause suffocation, similar to other asphyxiant gases such as propane, helium, hydrogen, methane. Nitrogen gas is inert and is not inherently toxic. However, it is dangerous with the displacement of oxygen, effectively diluting the concentration of oxygen in the air⁷. If pure nitrogen is inhaled, the alveolar spaces gradually become filled with nitrogen, and alveolar oxygen concentration decreases⁸.

Symptoms of nitrogen gas inhalation vary with the degree of oxygen deficiency⁹⁾. At an oxygen concentration of 15-20% in inhaled air, work performance may be decreased, while at 8-10%, loss of consciousness may occur, and an oxygen concentration of less than 8% can be fatal. According to animal studies, death can occur within a few seconds to a few minutes, and this is determined not only by the initial concentration of oxygen, but also by the rate at which the oxygen concentration is decreased¹⁰⁾. When oxygen is absent, asphyxiation occurs within 2 to 3 minutes, while when oxygen is gradually reduced, asphyxiation develops within 20 to 25 minutes¹⁰⁾. These animals tend to display vigorous jumping (possibly an avoidance movement), and develop severe convulsions¹⁰⁾. Treatment is symptomatic, as there is no antidote to nitrogen asphyxiation¹¹⁾. For patient with bronchospasm, bronhcodilators can be used. There are no specific tests that can diagnose nitrogen gas asphyxiation. So thorough history taking is most important if a patient suspected of asphyxiation by nitrogen gas is in the emergency room. Because of nitrogen gas itself is not toxic, clinical symptoms are likely to be associated with hypoxia.

Death due to nitrogen gas asphyxiation has been occasionally reported; however, reports of survival are very rare. A case report by Tur and Aksay¹²⁾ described a non-fatal incident of nitrogen asphyxiation, in which the patient was exposed to nitrogen gas accidentally in an oil refinery and experienced anterograde amnesia, and was eventually discharged in a fully alert state. In our case, in addition to decreased consciousness, transient lactic acidosis, transient hyperammonemia, and rhabdomyolysis were also observed. The patient is presumed to have a seizure induced by hypoxia. Transient lactic acidosis and transient hyperammonemia can be caused by seizure¹³⁻⁶⁾. And dilated pupils can be associated with postictal state¹⁷⁾.

The patient eventually fully recovered without complications, and this good result may be a result of the situation in which the attempted suicide took place. The patient used a nitrogen cylinder, which was attached to an unsealed plastic bag on his head. Thus, the atmospheric oxygen decreased gradually

and he lost consciousness. Thereafter, the nitrogen gas may not have been continuously injected into the bag, resulting in a decrease in the concentration of the inhaled nitrogen gas, thereby increasing the oxygen concentration.

Our patient was a suicide attempt patient. Information regarding suicide methods is readily available, with more than 100,000 websites containing such information¹⁸⁾. The current patient also gathered information through suicide information websites. Quick and painless suicide can be attained with nitrogen gas, as most people lose consciousness within 12 seconds, and can die within minutes⁶⁾. In addition, nitrogen gas can be easily purchased over the Internet throughout the world, and although implementation of strict regulations regarding the usage of nitrogen gas is difficult, the potential increase in suicide rates by nitrogen gas should be considered to revise legal regulation.

Conclusion

Nitrogen gas inhalation causes oxygen deficiency by displacing the tmospheric oxygen, which can be fatal. In our case, the symptoms may be reversible. Appropriate initial treatment and rapid rescue from the nitrogen gas is very important. Suicide attempts using nitrogen gas will increase due to the easy availability and fast and painless effects of this gas. The emergency physician should be aware of the potentially fatal misuse of nitrogen gas as method of suicide.

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