

Survivor from asphyxiation due to helium inhalation

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Abstract

In this rare case report we describe a 27-year-old white man survived to suicide by asphyxiation using the so-called *suicide bag* (or *exit bag*) filled with helium supplied through a plastic tube. He had no previous psychiatric or organic illnesses. At the time of presentation to our Emergency Department he was awake and reported severe dyspnea with a clinical pattern of acute respiratory failure. Imaging studies showed pulmonary edema and the patient was treated with non-invasive ventilation in Intensive Care Unit. After 15 days the patient was discharged from hospital in optimal conditions. These rare cases of survivor might suggest the possible causes of death from inhaling helium.

Case Report

A 27-year-old male student was rescued at home by his father: he was found to be uncounscious with so-called *suicide bag* (or *exit bag*) filled with helium supplied through a plastic tube. Immediately he removed the bag (not really narrow neck) from the head and called the emergency number.

When the ambulance arrived he was found with prompt resumption of breathing and slow recovery of consciousness with peripheral cyanosis, pulse rate was 130/minute and blood pressure 160/90 mmHg. On arrival at the Emergency Department he was conscious with hemodynamic stability, the respiratory rate was 35/min, peripheral pulse oxymetry revealed SpO₂ of 80% in air. Past medical history was negative.

Thoracic fine crepitations were auscultated on both sides. Heart sound was normal. Hemogasanalysis showed a severe respiratory failure with PaO₂/FiO₂ value of 120. Electrocardiogram revealed non-abnormalities except sinus tachycardia. We performed a chest X-ray and a bedside lung ultrasound with convex probe 5 MHz that revealed a bilateral B-pattern typical of interstitial syndrome, mainly due to acute pulmonary edema. Inferior vena

cava and heart contractility were normal (studied with a cardiac phased array probe 2.5 MHz). Moreover it was performed a thoracic CT scan which confirmed the diagnosis of bilateral pulmonary edema that was bilateral, symmetric, ground-glass like, and not involving the anterior areas of the chest.

A non-invasive ventilation (NIV) with full-face mask was applied. Ventilatory settings were as follows: FiO₂ 50%, PEEP 10 cm of H₂O, PS 5 cm of H₂O. Blood test was normal except for a slight increase of troponins.

He was transferred to the Intensive Care Unit. On the three day of hospitalization patient was successfully weaned off the non invasive ventilator: pulse rate was 80/minute and blood pressure 120/70 mm of Hg, the respiratory rate was 15/min, SpO₂ of 98%. Then he was transferred to the pulmonology ward.

The patient remained asymptomatic over the next 10 days. Blood test was normal. Chest was clinically clear. After being subjected to a psychiatric evaluation, he was discharged from the hospital.

Discussion

Helium is one of inert gases causing physical asphyxiation, whose excess content in the breathing atmosphere reduces the partial pressure of oxygen and may be fatal after short-term exposure. When breathing a mixture of an inert gas (helium, nitrogen, argon) with a small amount of oxygen, with the possibility of exhaling carbon dioxide, no warning signs characteristic of suffocation are perceived by the subject. Freedom from discomfort and pain, effectiveness, rapid effect and relatively easy availability of required accessories have resulted in the use of inert gases for suicidal purposes. This case report a suicide attempt by using a kit consisting of the so-called *suicide bag* filled with helium supplied through a plastic tube.¹⁻³ This rare case survived shows the pathophysiology of pulmonary edema from pure severe hypoxia at sea level because helium is an inert gas that only reduces the partial pressure of oxygen. The process of hypoxic pulmonary vasoconstriction (HPV) was first identified in 1894, as a rise in pulmonary arterial pressure upon asphyxia.⁴ Alveolar hypoxia leads to an adaptative vasomotor response in the form of hypoxic pulmonary vasoconstriction.⁵ The pulmonary capillary pressure increases as a result of HPV, which occurs mainly in smaller pulmonary arteries. As a result of the constriction of small pulmonary arteries, blood gets diverted away, causing elevated blood flow and raising the pressure, which consequently leads an the increase in capillary permeability mainly in areas more perfused.⁶ our pulmonary edema

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was bilateral, symmetric, ground-glass like, and not involving the anterior areas of the chest probably due to supine position of the patient.

Another mechanism involved in pulmonary edema is a sympathetic activation: an intense activation of the sympathetic nervous system and the release of catecholamines are the prime contributors to exaggerated HPV.⁷ Furthermore, severe hypoxia causes cerebral edema and elevation in intracranial pressure (ICP). Elevated ICP levels correlate with increased levels of extravascular lung water (EVLW) playing an important role in the pathogenesis of neurogenic pulmonary edema (NPE).⁸

Conclusions

To conclude, in this case we describe the beginning, evolution and resolution of a non-cardiogenic pulmonary edema due to asphyxiation caused by helium inhalation. Extreme hypoxia and sympathetic activation are the main causes of the development of pulmonary edema with high mortality and only autopsy cases *post-mortem*. Instead, in this rare case of surviving we have observed the consequences of an event such as extreme hypoxia that is a reversible process once recognized and properly treated.

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