

CASE REPORT

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Death at High Altitude in the Hypobaric Chamber

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ABSTRACT: A small number of accidental and suicidal deaths have occurred in the hypobaric, or high altitude, chamber. A case of an unusual suicide in a hypobaric chamber is presented. The changes that resulted from decompression and hypoxia are discussed.

KEYWORDS: pathology and biology, asphyxia, decompression, hypobaric chamber, hypoxia, suicide

The hypobaric, or high altitude, chamber has been used for training commercial and military aviation personnel for many years. Such training is necessary to acquaint pilots flying high performance, high altitude aircraft with the potential dangers of decompression associated with hypoxia (decreased oxygen) and gas evolution from body fluids. Training is conducted under controlled conditions: the trainees are taken to simulated altitudes (effected by removing air from the hypobaric chamber) between 7 620 to 10 668 m (25 000 and 35 000 ft). They wear oxygen masks, that are removed, under supervision, for a short period so that the symptoms of hypoxia may be recognized and experienced.

The incidence of morbidity and mortality from exposure to hypobaric pressures has been very low, particularly since the 1950s. Of 16 fatalities⁴ known to have occurred in the United States, Canada, and Great Britain, we have identified a total of 13 deaths in the hypobaric chamber that were accidental [1-3]. The other three deaths were suicides. We present here an example of an unusual suicide resulting from hypoxia in a hypobaric chamber.

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⁴Verifiable deaths from accessioned cases at the Armed Forces Institute of Pathology, and one undocumented case.

Case Report

A 22-year-old Air Force technician was found dead inside a six-man hypobaric chamber by a co-worker. The latter had gone to the physiological training unit building on a weekend day and had noticed that the vacuum pump (used to evacuate air from the chamber) was operating. He found the controls set for maximum climb, with the altitude reading approximately 30 480 m (100 000 ft). After he had begun equalizing the pressure of the outside environment and that of the interior of the chamber, he called the police and the emergency room of a nearby hospital. Access was gained to the chamber after the pressures were equalized. Figure 1 shows the outside of the chamber, with the door slightly open. The large latches used to fasten the door were found in the open position.

The deceased was found sitting in a chair with his feet propped up on another chair. There were three oxygen regulators on the wall, but no oxygen masks were found inside the chamber. On the floor, next to the victim, were a screwdriver, a hammer, and several buttons. A number of abnormalities were immediately apparent; the body was clothed in shoes, socks, slacks, shirt, and vest. The bottom four buttons were missing from the vest. The face and fingernails were cyanotic. A moderate amount of dried blood was found on the lower face, around the nose and mouth, and on the upper chest (Fig. 2).

Evidence of suicidal intent was found in the office area, outside the hypobaric chamber. On a desk was a sealed envelope addressed to the victim's supervisor. The envelope contained a typed letter (dated two days before the death), a handwritten note, and some money. The letter



FIG. 1—Exterior of the hypobaric chamber. A chair is visible inside the door. (Credit: Armed Forces Institute of Pathology.)

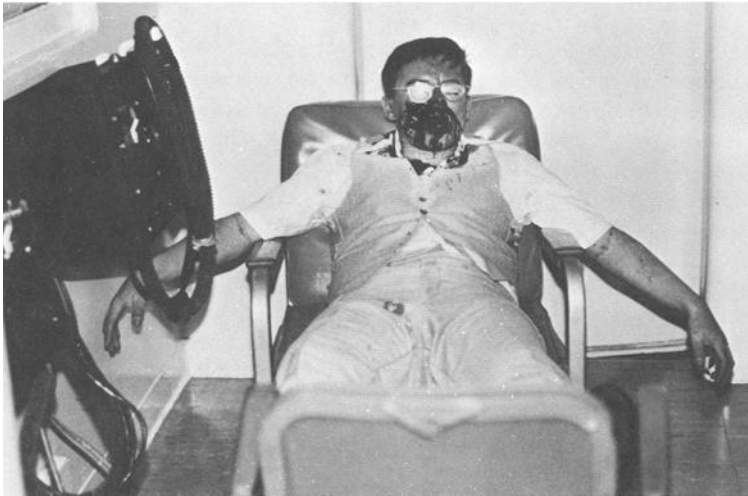


FIG. 2—Body of the victim inside the chamber. (Credit: Armed Forces Institute of Pathology.)

expressed the victim's regret for using the chamber for that end and revealed a negative self-image: "Tell them not to grieve too long, I am obviously not worth it." The handwritten note named the person to whom the money was to be given. Also in the office area was a sign out board containing the names of the technicians that worked in the unit. Opposite the deceased's name the word "dead" had been written in all capitals with a grease pencil.

The postmortem examination, performed the following day, noted the cyanosis and dried blood. In addition, numerous petechiae were found on the face. Several bullae were on the back in the shoulder area. Internal examination revealed moderate to severe distension of the stomach and intestines by air. The lungs were quite small—one-third normal size—and did not extend below the fourth rib in the pleural cavities. No air bubbles were found in the cerebral vessels, and no other abnormalities were found at the postmortem examination.

The chamber was tested the day after the death. It was found that a vacuum seal could be easily created by holding the door closed with a hammer and a screwdriver. Sufficient pressure differential was created between the outside and the inside of the chamber to hold the door shut when the altimeter indicated 259 m (850 ft). Following that test, a second test was performed to determine the time required to reach certain altitudes with the controls set for maximum. Table 1 indicates the results of this test.

TABLE 1—Time required to reach altitude.

Altitude		Time, min
Metres	Feet	
1 524	5 000	0.07
3 048	10 000	0.18
4 572	15 000	0.31
9 144	30 000	1.12
19 202	63 000	3.17
22 860	75 000	4.17
29 870	98 000	7.00

Discussion

The victim in this suicide was a technician who worked in the physiological training unit and was entirely familiar with the operation of the hypobaric chamber. Although the building was ordinarily secure during nonworking hours, he was able to gain access to the chamber because he worked there. He circumvented the problem of securing the chamber door by using a hammer and a screwdriver to hold the door shut until a pressure differential was created whereby the pressure of the outside air held the door shut.

The cause of death was asphyxia as a result of oxygen depletion. There are a number of unusual aspects of death under these conditions. Unconsciousness results rapidly (from hypoxia) at an altitude of 9144 m (30 000 ft). The victim was probably unconscious within 1 to 2 min after the door was closed. The moderate amount of blood on the face and chest came from the bleeding from the mucous membrane of the nose. Blood boils at an altitude of 19 202 m (63 000 ft) at normal body temperature. Blood literally boiled from the victim's nose after he reached this altitude.

The postmortem examination revealed changes consistent in general with asphyxia. The cyanosis of the face and fingernails was due to reduced hemoglobin caused by the hypoxia. The petechiae were also a nonspecific indication of asphyxia. Changes in the lungs and gastrointestinal system were specific changes associated with decompression in this case. The distension of the stomach and intestines was caused by the expansion of residual air in these organs. With the rapidly decreasing pressure inside the chamber, the air in the stomach and intestines expanded sufficiently to pop the lower four buttons off the vest. In contrast, communication of the tracheobronchial tree with the hypobaric environment resulted in the collapse of the lungs.

Summary

An unusual case of suicide in a hypobaric, or high altitude, chamber has been reviewed. The cause of death was asphyxia as a result of oxygen depletion. The nonspecific signs of asphyxia were accompanied by physical changes in the respiratory and gastrointestinal systems and resulted from the very low pressures generated in the hypobaric chamber.

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