CASE REPORT

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"The Santa Claus Syndrome" Entrapment in Chimneys

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ABSTRACT: In recent years, there have been sporadic reports in the lay press of individuals stuck in chimneys primarily during burglary attempts. Most of these individuals suffered from suffocation or soot inhalation. Because of the similarities between this form of breaking and entering and Santa Claus' traditional entrance into homes on Christmas Eve, we define the "Santa Claus Syndrome" as postural (positional) asphyxia, inhalational injuries and body burns, and/or complications related to compartment syndrome due to entrapment in chimneys. We report a case of a man who became trapped in a chimney during a burglary attempt and died a delayed death due to postural asphyxia associated with inhalational and burn injuries and anterior compartment syndrome. An analysis of this unusual case is presented. Exhaustional and postural asphyxia, compartment syndromes, and confined space-hypoxia syndrome are also discussed.

KEYWORDS: pathology and biology, postural asphyxia, positional asphyxia, chimneys, entrapment, confined space, inhalational injuries, compartment syndromes, accident

The use of chimneys as a means of illegal entrance into residential and commercial dwellings poses an unforeseen danger to burglars. Entrapment in confined spaces may lead to postural (positional) asphyxia, exhaustion, and anterior tibial compartment syndrome. The confined space of a chimney, combined with the liberation of combustible materials found in soot, may also cause suffocation and/or soot inhalation.

Case Report

A 17-year-old male reportedly attempted to burglarize a store during the early morning hours by climbing down the chimney. Fourteen hours later, he was found by paramedics stuck upright in the chimney with his hand caught in a heat vent. He was extricated and transferred to a burn unit of a New York City hospital.

On admission to the hospital, the patient was alert and oriented to name and place but not to time. His temperature was 96°F, his pulse was 110 and regular, and his respirations were 30. The blood pressure was 90/60 mmHg. The nostrils and tongue were covered with an abundant amount of black soot. No petechial hemorrhages were noted on the face. The chest, abdomen, and lower extremities showed extensive first and second degree burns, as well as multiple small contusions and abrasions over the bony prominences. The right knee showed pressure necrosis and the right hand was gangrenous. The anterior compartment pressure of the right leg was 22 mmHg and the posterior pressure was 20 mmHg. The anterior compartment pressure of the left leg was 16 mmHg and the posterior pressure was 22 mmHg. Dorsalis pedis and posterior tibial pulses were palpable.

The hematocrit was 58.4%, the white blood cell count was 21,500 with 80% neutrophils and 6% band forms; the platelet count 283,000. The sodium was 140 mmol, the potassium 8.1 mmol, the chloride 98 mmol, and the carbon dioxide 11 mmol. The urea nitrogen was 63 mmol and the creatinine was 3.8 mmol, and the glucose 143 mmol. The amylase was 1960 U per liter. The creatinine kinase was greater than 40,000 U per liter. The pH was 7.09, the $paCO_2$ 46.2 mmHg, the paO_2 68.8 mmHg, and the HCO_3 − 13.4 mmHg. The oxygen saturation was 83.4%.

The carboxyhemoglobin blood saturation level was 10.6 percent. A toxicologic screen was negative for drugs and alcohol. The chest X-ray was within normal limits. X-ray films of the pelvis and right femur showed no evidence of fractures or pathologic bone conditions.

The patient required endotracheal intubation for inhalation injuries and subsequently developed acute respiratory distress syndrome (ARDS). He was treated empirically with broad-spectrum antibiotics, intravenous steriods, and aggressive fluid resuscitation. He developed progressive renal failure due to myoglobinuria, and hemodialysis was begun on the second hospital day. Four days following admission, the right hand and distal forearm were amputated because of mummification. The lower extremities showed anterolateral and posterior compartment syndromes that required bilateral fasciotomies with split-thickness skin grafts.

Twelve days after admission, the patient suffered a cardiorespiratory arrest. Resuscitative efforts were unsuccessful.

A medicolegal autopsy was performed and the cause of death was attributed to complications of positional asphyxia and compartment syndrome associated with inhalational and burn injuries. There was no evidence of pre-existing pathological conditions. The manner of death was classified as accidental.

Discussion

We define the "Santa Claus Syndrome" (SCS) as a constellation of findings, including: postural (positional) asphyxia, body and inhalational burns, and compartment syndrome due to entrapment in chimneys.

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The typical diagnosis of postural (positional) asphyxia depends on the following factors: (1) the circumstances of death involve a person found in a restrictive or confining position; (2) the victim accidentally placed himself in a precarious position; (3) the person was unable to extricate himself from the dangerous environment due to chemical intoxication or dementia; (4) the upper airways were unobstructed; (5) the toxicology screen was negative for carbon monoxide and other suffocating gases; and (6) the autopsy revealed no evidence of significant pre-existing cardiovascular disease [*1,2*].

The differences between SCS and classic postural asphyxia are: (1) the victim is entrapped in the confined space of a chimney; (2) air contaminants unique to chimneys might be detected on the toxicology screen; (3) the victim suffers from positional circulatory compromise, which causes a combination of asphyxia and exhaustion [*3,4*]; and (4) anterior tibial compartment syndrome exists due to impaired circulation from prolonged suspention in a vertical position.

The types of injuries related to SCS will vary depending on: (1) the anatomy of the victim, (2) his clothing, (3) the season of the year, (4) the design and functioning of the chimney, (5) the length of time of entrapment, and (6) the position of the victim inside the chimney. If the victim sustains a penetrating injury with laceration of a major blood vessel or vital organ from contact with the interior of the chimney during descent, he may also suffer from hemorrhagic shock. Deaths and injuries in chimneys are extremely rare occurrences. Newspaper accounts have concentrated on the circumstances surrounding chimney entrapment [*5–10*]. Since the majority of cases reported involve burglars, some of them might suffer from drug addictions and be intoxicated during the commission of the crime. The effect of drugs and/or alcohol might contribute to the victim's lack of judgement and inability to extricate himself from the perilous situation. There has also been a news report of a college student who died in a chimney during a fraternity prank [*11*].

Zugibe coined the confined space-hypoxia syndrome as deaths occurring in confined spaces due to oxygen deficient atmospheres (16% or less is considered to be immediately dangerous to life) [*12*]. The limited ventilation, combined with frequent alterations in oxygen content, is sometimes complicated by the liberation of noxious products [*13*]. Contamination is produced by oxygen deficiency combined with concentrations of explosive or flammable materials and toxic substances [*12*]. It is well-known that soot, dust, cobwebs, and a variety of flammable materials frequently accumulate in chimneys [*14*]. Creosote ($C_8H_{10}O_2$), a volatile, flammable wood preservative derived from coal, often accumulates in wood-burning chimneys reducing the flue diameter and contributing to a person becoming wedged [*14–16*].

In 1881, Volkmann first described the anterior tibial compartment syndrome in the setting of trauma or crush injuries [*17,18*]. It consists of a spectrum of disorders leading to local circulatory compromise with subsequent ischemic muscle or nerve damage. There is swelling and increased pressure in the tight compartment resulting in ischemia. The symptoms are pain in this area and distally, with reduced or absent foot pulses and neurological changes. The calf might also be swollen, tight, and tender. Cell necrosis associated with rhabdomyolysis, myoglobinuria, and acute renal failure occurs in severe cases. The leg is especially prone to the compartment syndrome because the muscles are enveloped in tight fascial compartments. Normal tissue pressure ranges from 10 to 12 mmHg [*19*]. In the case reported herein, the patient suffered from early compartment syndrome: the anterior and posterior compartment pressures of the right leg were 22 mmHg and 20 mmHg, respectively; those of the left leg were 16 mmHg and 22 mmHg, respectively. Intrafascicular pressures exceeding 30 mmHg begin to impede local blood flow. When systemic systolic blood pressure is matched or exceeded, tissue blood flow ceases. Irreversible nerve injury may be seen in 4 hours. Muscle cell death begins within 8 hours of the ischemic insult. After 12 hours, only 8% of patients may have a significant return of muscle function [*20*].

In summary, burglars and pranksters who enter businesses and residences via chimneys may present with injuries related to the "Santa Claus Syndrome."

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