K29 Fatal Death of an 8-Year-Old Boy From an Explosion Caused by Escaping Butane: Asphyxiation or Death by Explosion?

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After attending this presentation, attendees will be briefed on the sudden death of a small boy involved in an explosion caused by escaping butane.

This presentation will impact the forensic science community by making the attendees aware of pathological and toxicological findings that clarify the cause(s) of death.

Flammable vapors of butane are capable of migrating through an area, creating a path for fire or explosion. Vapors that spread throughout an enclosed space may become flammable or explosive if they encounter an ignition source, whether it be a flame, pilot light, spark, or friction. On the other hand, butane at high concentration can cause asphyxiation as described in several accident or suicide cases.[1]

An 8-year-old boy was found dead under the wreckage of his home which collapsed after an explosion caused by escaping butane. One thousand liters of butane had been contained in a tank in the garden that was found empty. Butane was supplied to the house for domestic use such as cooking and heating. The butane leak inside the home happened during the night and was caused by the accidental turning off of the cooker.

The goal of this forensic investigation was to clarify the cause of death and identify the factors involved in the accident. In fact, considering the large amount of butane which had escaped, it was essential to determine if death was caused by asphyxiation or by explosion.

Toxicological analyses were performed on blood, liver and fat tissues. Butane was determined in all biological samples by HS/GC-MS. Calibrations were performed in matrix in the case of blood, while the butane amount released by the tissues was estimated using a vial to which a fixed volume of butane gaseous solution had been previously added.

Autopsy findings: External examination of the body revealed burn injuries exceeding 80% of the body surface mainly localized on the left part of the face and the thorax. These injuries could not have caused the death of the boy. Internal examination showed extensive head injuries and spinal transection with C2–C3 fractures. Fractures were also revealed in the rib cage, pelvis, and in the arms. Macroscopically, hemorrhagic edemas and passive congestion were evident in lung.

Toxicological results: Analyses confirmed that the boy had inhaled butane before death. Butane was revealed in blood at a concentration of 0.78 mg/g, while after headspace extraction, liver and fat tissue released 0.96 mg/g and 0.015 mg/g of butane, respectively. However, these results, mainly those relating to the fat tissue, demonstrate that the butane concentrations, to which the boy had been exposed, were not sufficient to have caused asphyxia.

In fact, aliphatic hydrocarbons, such as butane are lipophilic so that after being taken up from the lungs into blood, they are distributed at high concentrations in lipid-rich tissues such as fat tissues, and also in liver.[1] This characteristic is also confirmed by Kow value of butane (630.96), which, being a measure of hydrophobicity, helps to understand and/or determine the fate of chemicals after exposure. Additionally, these tissue concentrations are generally lower than those reported in butane asphyxiation cases. On the other hand, its determination also in fat tissue demonstrates that the butane leak had been particularly slow because of the body distribution of the toxicant.

Pathological and toxicological findings demonstrated that death occurred after a very short time and was not caused by butane asphyxiation. The victim's injuries localized on the front side indicated that when the accident occurred the boy was standing in front of the source of explosion. Probably, the boy himself had caused gas ignition by switching on the light. However, the autopsy showed that death was not caused by burn injures but was mainly related to the injures caused by the building collapsing.

Reference:

1. Sugie H, Sasaki C, Hashimoto C, Takeshita H, Nagai T, Nakamura S, et al. Three cases of sudden death due to butane or propane gas inhalation: analysis of tissues for gas components. Forensic Sci Int 2004 Jul 16;143(2-3):211-4.

Butane, Explosion, Asphyxia

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