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CASE REPORT

Death due to Liquified Petroleum Gas Inhalation Augmented with Plastic Bag Suffocation

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ABSTRAK

Gas petroleum cecair biasanya mengandungi butana dan propana, yang tergolong dalam keluarga hidrokarbon alifatik yang tidak berwarna dan tersedia secara komersial. Kadang-kadang disalahgunakan sebagai bahan inhalan meruap yang boleh mengubah keadaan mental atau untuk membunuh diri. Kes kematian yang tidak disengajakan akibat kombinasi penyedutan hidrokarbon dari gas petroleum cecair dan sesak nafas disebabkan oleh beg plastik jarang dilaporkan. Seorang lelaki berusia 44 tahun dilaporkan ditemui berbogel, hanya sebahagiannya ditutup dengan selimut di dalam biliknya, dengan kepala ditutup dengan beg plastik nipis berwarna hitam dan disambungkan ke tangki silinder gas memasak. Beg plastik itu diubah suai untuk mengelakkan kebocoran gas. Tambahan pula, peralatan pornografi juga ditemui pada telefon bimbit di sebelahnya. Tiada risiko bunuh diri dicatatkan sebelum kematian. Penyiasatan mengenai kematian yang berkaitan dengan penyedutan gas petroleum cecair berserta dengan beg plastik di kepala, adalah penting untuk memahami cara kematian dalam kes seperti ini. Kes ini menimbulkan persoalan mengenai kemungkinan kematian tidak sengaja memandangkan ketiadaan petunjuk bunuh diri yang jelas menunjukkan kemungkinan kematian yang tidak disengajakan.

Kata kunci: Butana; gas petroleum cecair; kematian autoerotik; lemas dengan beg plastik; patologi forensik

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ABSTRACT

Liquified petroleum gas usually contains butane and propane, which are the family of aliphatic hydrocarbons that are colourless and commercially available, sometimes abused as a volatile inhalant to obtain psychoactive effects or to commit suicide. Instances of non-suicidal death resulting from a combination of inhalation of hydrocarbon from liquified petroleum gas and plastic bag suffocation are uncommonly reported. A 44-year-old man was allegedly discovered naked, only partially covered with the comforter, inside his bedroom, with the head covered with a black and thin plastic bag connecting to a cooking gas cylinder tank. The plastic bag was modified to prevent a gas leak. Additionally, pornographic paraphernalia was found on the mobile phone beside him. No suicidal risk was noted before death. The investigation of deaths associated with the inhalation of liquified petroleum gas, together with the plastic bag around the head, is crucial for comprehending the underlying manner of death in such fatalities. The present case prompts inquiries into accidental, as the absence of clear suicidal indicators suggests the possibility of unintentional death.

Keywords: Autoerotic death; butane; forensic pathology; liquified petroleum; plastic bag suffocation

INTRODUCTION

Fatalities from inhaling volatile substances or gases can occur accidentally or intentionally and may encompass various inhalants such as petrol, butane, propane, toluene or helium. One study regarding the analysis of death due to inhalants was done in South Australia showed that most of the deaths happened due to accidents instead of suicides, which suicides only account for less than one-third of the study (Wick et al. 2007). Males were more common than females involved in inhalants-related death, with a ratio of about 12 to 1. Most were involved in people younger than 30 years old (Bowen et al. 1999; Maxwell 2001; Wick et al. 2007). Liquified petroleum gas (LPG), which contained mainly propane and butane, was commonly encountered after petrol and butane (Wick et al. 2007).

Butane (C4H10) and propane (C3H8) belong to the aliphatic hydrocarbons family has the potential to induce psychoactive effects like euphoria and, in extreme cases, can lead to sudden death due to fatal arrhythmias resulting from the cardiotoxic nature of the substances (Bhuvaneswari et al. 2020; DiMaio & Molina 2021). Usually, butane or propane, which the youngster commonly abused, was found in handy objects such as cigarette lighters or deodorant sprays (Jackowski et al. 2005).

Most of the cases were reported of people using LPG propane and butane as inhalants either to commit suicide, to achieve autoerotic satisfaction or as substances of abuse to achieve psychoactive effects (Jackowski et al. 2005; Wick et al. 2007; Zivkovic et al. 2010). Only a few cases were reported

using a plastic bag connected to an LPG gas tank, as most of the time, the method of delivering the volatile substance is either through sniffing, huffing or bagging (Kurtzman et al. 2001; Zivkovic et al. 2010) We described a case of LPG inhalations augmented with plastic bag asphyxia in possible association with autoerotic death.

CASE REPORT

Case History

A 44-year-old man was uncontactable by family members and friends for a few days. During a subsequent search by his family members together with the police, he was allegedly found dead inside his bedroom in his house in a supine position with his head covered with a plastic black, thin bag and connected to a cooking gas cylinder tank which contained butane and propane (Figure 1). Multiple empty butane cartridges were also retrieved at the scene beside his bed, despite the house not having a portable stove or heating appliance for using the butane cartridges. Fortunately, the phone was unlocked, and it helped the investigation team understand the ongoing situation. Pornographic paraphernalia was present inside his mobile phone upon unlocking. No suicidal indicator or risk was obtained through the phone or from the history, according to the next of kin and close friends.

Autopsy Findings

The autopsy was performed about 12 hours after the family members and police found the body. The external examination

FIGURE 1: The head was covered with a plastic bag with the gas regulator, which the police had already detached. Three empty butane gas cartridges were on the floor (green arrow)

of the body revealed that the body was in a moderately decomposed state, with the head covered with a black plastic bag that was not tightly attached around the neck with a hose connected to a regulator (Figure 2 & 3). There was no external injury and absence of defensive wounds. A distinct dark greenish discolouration, skin marblings and slippage were seen. Organ examination showed a decomposition changes. No other remarkable findings were noted. A histopathological examination of the tissue from each organ was performed, but the findings were consistent with decomposition changes.

Toxicology Analysis

Multiple specimens from the brain, heart, lungs, kidney, liver and bile fluid were taken as the blood failed to be obtained to test for the illicit and common drugs and toxicologic agents, including volatile substances. The investigation officer team sent the specimen to the forensic chemistry laboratory, a separate agency from the forensic pathology and the police department. Headspace Gas Chromatography-Mass Spectrometry, which is an analytical technique used to identify and quantify volatile compounds

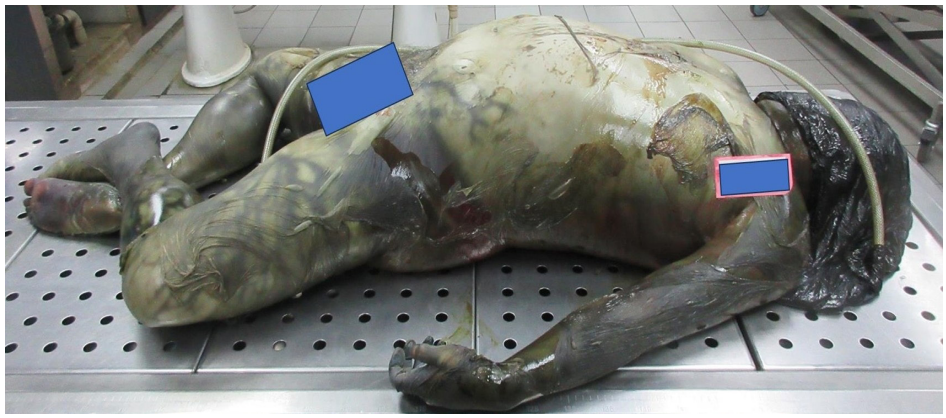

FIGURE 2: A decomposed body with the head was covered with a black plastic bag and connected to the hose

FIGURE 3: The hose from the regulator that connected to the plastic bag

present in a sample was done. However, only butane was detected and isolated from the liver. The butane toxicology analysis results were qualitative. None of the drugs, pesticides and other volatile substances were detected.

DISCUSSION

Investigating fatalities involve volatile substance inhalation with elements of asphyxia is crucial in understanding the

underlying mechanisms and the manner of death. In this case, the absence of clear suicidal indicators, coupled with the presence of multiple used butane cartridges and pornographic paraphernalia, suggests the possibility of accidental death during autoerotic activity.

Volatile substances like butane and propane in the LPG gas cylinder connected to the plastic bag can cause fatality through several mechanisms. One primary mechanism is oxygen depletion due to oxygen displacement in the respired air by butane or propane. Normal air contains approximately 21% oxygen, 78% nitrogen and about 0.03% carbon dioxide. In this case, the increased supply of butane and propane gas, combined with head trapping in a plastic bag, displaced oxygen, leading to hypoxia and, subsequently, loss of consciousness and death (DiMaio & Molina 2021).

Another significant mechanism involves the direct toxic effects of butane and propane. Butane, in particular, is known as a euphoric agent and has cardiotoxic effects, respiratory depression and neurotoxicity (Jackowski et al. 2005; Piersanti et al. 2024). The inhalation of butane can induce fatal arrhythmias by sensitising the heart to catecholamines, which are naturally increased during sexual activity. The sequelae of the sensitisation can lead to sudden cardiac death, a well-documented phenomenon in cases of volatile substance abuse (Jackowski et al. 2005).

There are two proposed theories behind the mechanism of death due to plastic bag suffocation. The first theory is due to electrostatic charges, which cause the plastic bag to adhere to the face and obstruct the external airway orifices to cause asphyxia. The second theory suggests that the stimulation of the sympathetic nervous system, which is stimulated by hypoxia or psychological stress during autoerotic activity, leads to fatal ventricular arrhythmias. This alternative explanation can account for the absence of typical pathological signs of asphyxia often seen in plastic bag suffocation cases (Piersanti et al. 2024; Santoro et al. 2019).

Deaths due to plastic bag suffocation or asphyxia are rare in Malaysia, with only two cases reported previously. However, in Western countries, many suicides by plastic bag asphyxia, particularly among the elderly and those who are chronically or terminally ill, have been documented. Accidental deaths involving plastic bags are also not uncommon occurring among small children who play with shopping bags and adolescents who abuse solvents. Another notable form of accidental death from plastic bag asphyxia is sexual asphyxia, which is predominantly seen among adult males (Nadesan & Beng 2001; Santoro et al. 2019).

Typical methods of autoerotic activity include hanging, ligature, plastic bags, chemical substances or combinations of these. Atypical methods, which are estimated to account for about 10% of autoerotic deaths, which include electrocution, overdressing/body wrapping, foreign-body insertion, or unconventional asphyxia techniques such as chest compression, inverted or abdominal suspension, immersion, and drowning (Sauvageau 2012). The use of plastic bags and chemical substances accounts for approximately 10% to 30% of autoerotic deaths. Autoerotic practitioners often inhale aerosol propellants,

chemicals and gases to achieve euphoric effects, commonly using substances such as hydrocarbons, anaesthetic compounds and chemical inhalants. Frequently used gaseous hydrocarbons include propane, butane, ethane and methane, while anaesthetic gases like nitrous oxide, ether, and chloroform are also common. Additionally, a wide range of inhalants, including vapours from products like glue, fingernail polish remover, hair spray, deodorant, varnish, paint thinner, lighter fluid, gasoline, window cleaner, spot remover, dry-cleaning agents, and spray-on cooking lubricants can be used to induce a high (Sauvageau & Geberth 2013).

In this case, the decedent probably died due to a combination of butane toxicity and plastic bag suffocation. The toxicology analysis identified butane in the liver, and the absence of other toxic substances ruled out mixed intoxication. The moderate decomposition of the body made it challenging to detect other volatile substances, as butane and propane are highly volatile and can be redistributed during the postmortem period to the fat tissues (Jackowski et al. 2005). Another possibility is chronic butane abuse, as indicated by the numerous empty butane canisters found at the scene, which could explain why only butane was detected in the liver, as the liver has a higher affinity towards butane (Vahabzadeh & Mégarbane 2022). The qualitative nature of the toxicology results further suggest that the butane concentration was possible to cause death, even without precise quantification, as the body was already in a decomposed state.

Additionally, the investigation ruled out foul play. The police and family members found no evidence of suicidal intent or previous psychiatric history. The presence of multiple empty butane cartridges and the phone containing pornographic material suggest that the decedent engaged in autoerotic practices. These findings align with the characteristics of autoerotic deaths, where individuals use various methods, including volatile substance inhalation, to enhance sexual experiences. Such cases often lack of clear suicidal indicators, as the primary intent is not self-harm but to achieve heightened arousal (Jackowski et al. 2005; Kurtzman et al. 2001; Musshoff et al. 2006).

In comparing this case with the literature, several similarities and differences emerge. For instance, the case reported by Jackowski et al. involved a younger individual and the detection of both propane and butane, along with tetrahydrocannabinol, indicating mixed substance use. In our case, only butane was isolated in the liver, with no traces of other toxicological substances. Despite this difference, both cases had a possibility of developing fatal arrhythmias that caused death (Jackowski et al. 2005).

In cases of butane toxicity, histopathological examination can reveal various changes depending on the time of death. In sudden deaths, the brain often shows hypoxic-ischemic encephalopathy, oedema and loss of Purkinje cells. The lungs may exhibit capillary congestion, oedema and alveolar haemorrhages, while the myocardium can present diffuse intermyofibrillar oedema with focal areas of waviness without cardiac fibrosis. For delayed deaths, changes such as rhabdomyolysis, pneumonia, hypoxic-ischemic encephalopathy, and encephalitis are observed (Piersanti et al. 2024). In this

particular case, decomposition limited the identification of specific histopathological changes.

CONCLUSION

The combination of inhaling volatile hydrocarbons and suffocation by a plastic bag forms a highly hazardous and lethal combination. Investigating deaths with a multidisciplinary team is crucial for understanding the underlying manner of death in such fatalities. This case prompts inquiries into accidental death, as the absence of clear suicidal indicators suggests the possibility of unintentional death during autoerotic activity. The findings underscore the importance of considering all possible mechanisms and conducting comprehensive toxicological analyses to determine the cause and manner of death accurately.

REFERENCES

Bhuvaneswari, R., Nagarajan, V., Chandiramouli, R. 2020. Physisorption of propane and butane vapors on novel Kagome antimonene sheets - A first-principles perception. *Chem Phys Lett* **754**: 137693.

Bowen, S.E., Daniel, J., Balster, R.L. 1999. Deaths associated with inhalant abuse in Virginia from 1987 to 1996. *Drug Alcohol Depend* **53**(3): 239-45.

DiMaio, V.J.M., Molina, D.K. 2021. *DiMaio's Forensic Pathology*. Boca Raton: CRC Press.

Jackowski, C., Römhild, W., Aebi, B., Bernhard, W., Krause, D., Dirnhofer, R. 2005. Autoerotic accident by inhalation of propane-butane gas mixture. *Am J Forensic Med Pathol* **26**(4): 355-9.

Kurtzman, T.L., Otsuka, K.N., Wahl, R.A. 2001. Inhalant abuse by adolescents. *J Adolesc Health* **28**(3): 170-80.

Maxwell, J.C. 2001. Deaths related to the inhalation of volatile substances in Texas: 1988-1998. *Am J Drug Alcohol Abuse* **27**(4): 689-97.

Musshoff, F., Padosch, S.A., Kroener, L.A., Madea, B. 2006. Accidental autoerotic death by volatile substance abuse or nonsexually motivated accidents? *Am J Forensic Med Pathol* **27**(2): 188-92.

Nadesan, K., Beng, O.B. 2001. Two cases of death due to plastic bag suffocation. *Med Sci Law* **41**(1): 78-82.

Piersanti, V., Napoletano, G., David, M.C., Ronchi, F.U., Marinelli, E., De Paola, L., Zaami, S. 2024. Sudden death due to butane abuse - An overview. *J Forensic Leg Med* **103**: 102662.

Santoro, P., La Russa, R., Besi, L., Volonnino, G., dell'Aquila, M., De Matties, A., Maiese, A. 2019. The forensic approach to plastic bag suffocation: Case reports and review of the literature. *Med Leg J* **87**(4): 214-20.

Sauvageau, A. 2012. Autoerotic deaths. *Am J Forensic Med Pathol* 33(2): 143-6.

Sauvageau, A., Geberth, V.J. 2013. *Autoerotic deaths: Practical forensic and investigative perspectives. Practical aspects of criminal and forensic investigations*. Boca Raton: CRC Press.

Vahabzadeh, M., Mégarbane, B. 2022. A two-decade review of butane toxicity as a substance of abuse. *Basic Clin Pharmacol Toxicol* **131**(3): 155-64.

Wick, R., Gilbert, J.D., Felgate, P., Byard, R.W. 2007. Inhalant deaths in South Australia. *Am J Forensic Med Pathol* **28**(4): 319-22.

Zivkovic, V., Jukovic, F., Nikolic, S. 2010. Suicidal asphyxiation by propane-butane mixture inside a plastic bag: Case report. *Srp Arh Celok Lek* **138**(5-6): 376-8.