ASIA PACIFIC JOURNAL of MEDICAL TOXICOLOGY
APJMT 13;4 http://apjmt.mums.ac.ir December 2024

CASE REPORT

Liquefied Petroleum Gas Poisoning in a Child: A Case Report from a Low-Middle Income Country

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Abstract

Introduction: Liquefied Petroleum Gas (LPG) is primarily a mixture of propane and butane, and in Pakistan, it typically contains 95-100% propane. With the increasing use of LPG, a rise in poisoning cases has been observed.
Case report: We are reporting the case of a 5-year-old male who presented to the pediatric emergency department with unconsciousness lasting approximately 30 minutes after being found near an LPG cylinder in the kitchen. Upon arrival, the patient was tachycardic, with a Glasgow Coma Scale (GCS) score of 11/15. The systemic examination was unremarkable, and the electrocardiogram (ECG) showed a normal sinus rhythm. However, troponin-I levels were elevated at 135 ng/L (normal range: 0-57 ng/L), and blood gases revealed mild acidosis with bicarbonate levels of 16.8. A repeat troponin-I measurement showed a significant increase to 749 ng/L, prompting initiation of inotropic support with epinephrine. After 12 hours, troponin-I levels began to decrease. The patient remained in the Pediatric Intensive Care Unit (PICU) for 36 hours before being discharged in stable condition.
Discussion: Propane gas is heavier than air, causing it to flow along the floors. It acts as an asphyxiating gas, displacing oxygen in the lungs and making breathing difficult. Propane primarily affects the respiratory, nervous, and cardiovascular systems.
Conclusion: This case highlights the importance of admitting children exposed to LPG to higher care units for close monitoring, as initial cardiac enzyme levels and ECG may appear normal but can rapidly worsen. Serial monitoring of cardiac enzymes and electrocardiograms is crucial to prevent lethal arrhythmias and cardiac dysfunction.

Keywords: Liquefied petroleum gas, propane, pediatric poisoning, Low-Middle Income, Pakistan

How to cite this article: Jamali AA, Shamasuddin L, Yunus A, Khan N. Liquefied Petroleum Gas Poisoning in a Child: A Case Report from a Low-Middle Income Country. *Asia Pac J Med Toxicol* 2024; 13(4): 171- 174.

INTRODUCTION

Liquefied Petroleum Gas (LPG) is a mixture of aliphatic hydrocarbons that is pressurized in cylinders and widely used for combustion in kitchens and vehicles [1]. Generally considered safe, LPG is typically available as a blend of propane and butane in varying concentrations, with ratios ranging from 100:0 to 20:80, respectively [2, 3]. According to the official page of Pakistan State Oil, the LPG available in Pakistan contains 95-100% propane and small fractions of butane, accounting for less than 5% [4]. Propane is a highly flammable, colorless, and odorless gas that transforms into a liquid under very low temperatures [5].

Globally, around three billion people use LPG for cooking purposes. Its use is regarded as superior to that of solid fuels and kerosene. Many international organizations advocate for LPG's usage as a cooking gas due to its clean emission profile, low sulfur content, and global surplus availability (LPG is produced as a byproduct of oil and natural gas production and refining) [6].

However, the increased utilization of LPG has led to a rise in cases of LPG poisoning. Most of these cases are reported in adults, with very few documented in children, often presenting with varied manifestations [1,7]. In this report, we detail the case of a 5-year-old male who presented with altered consciousness and elevated cardiac enzymes. The patient arrived with a Glasgow Coma Scale (GCS) score of 11/15 and tachycardia, necessitating admission to the pediatric intensive care unit (PICU) for close monitoring. Over time, the patient's GCS and cardiac enzyme levels improved gradually without any specific interventions. He was discharged in stable condition after 36 hours, with no residual effects.

CASE PRESENTATION

5-year-old male child presented in the pediatric emergency department (PED) with a complaint of unconsciousness for around 30 minutes. The patient was found unconscious in the kitchen along with his mother and housemaid by his 12-year-old brother. The child was having no co-morbid and was all right before this unwitnessed event. A Liquefied petroleum gas (LPG) cylinder was also present in the kitchen. There were no spills of any poisonous material near the victims. On arrival in PED patient was found slightly tachycardiac with a heart rate of 140 beats per minute although other vitals were normal (Respiratory rate of 26 breaths per minute, blood

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pressure 97/64 mmHg, and oxygen saturation of 100% at room air) Patient was having no pain at arrival and no marks of trauma or fall were observed over the body. There was no jaundice, dehydration, cyanosis, or raised jugular veins on arrival. Capillary refill time was 3 seconds and peripheries were warm with normal volume and normal rhythm pulses. The patient landed in PED with a Glasgow coma scale (GCS) of 11/15 (E3+M5+V3), although the remaining neurological examination was unremarkable. Other systemic examinations were also unremarkable except for mild tachycardia.

A toxicologist was consulted, leading to the impression of propane (LPG) poisoning. The patient's laboratory workup was initiated, and an ECG revealed a normal sinus rhythm, although troponin-I levels were elevated at 135 ng/L (normal value: 0-57 ng/L). Upon arrival, blood gases indicated a pH of 7.34, bicarbonate of 16.80, pCO2 of 31.70, pO2 of 220.0, and a base deficit of -7.6. Electrolytes, renal function, liver function, and clotting profiles were all normal. The complete blood count (CBC) showed elevated white blood cell (WBC) counts with neutrophilia but no left shift, which was considered reactionary. The patient was administered intravenous fluids, including a 10 mL/kg bolus of 0.9% saline, followed by maintenance fluids with 0.45% saline and 5% dextrose. Bicarbonate was administered at a dose of 1 mEq/kg, diluted in an equal volume of 10% dextrose water. The patient was also kept nil per os (NPO).

Pediatric cardiology was involved, and they recommended serial monitoring of cardiac enzymes and echocardiography. Four hours after the poisoning, troponin I levels were significantly elevated at 749 ng/L, prompting the cardiology team to advise the initiation of inotropic support (epinephrine). The patient was admitted to the Pediatric Intensive Care Unit (PICU) for close monitoring of cardiac enzymes.

Subsequent echocardiography showed normal results, with a left ventricular ejection fraction greater than 65%, leading to a tapering and eventual cessation of inotropic support as the patient maintained stable blood pressure and heart rate. Eight hours after the second troponin I test, a third troponin I measurement indicated a decrease to 226 ng/L, which further dropped to 135 ng/L after another eight hours. Blood gases repeated after eight hours returned to normal. The patient remained in the PICU for approximately 36 hours and was discharged home in stable condition.

DISCUSSION

Propane gas is heavier than air, causing it to flow along the floors. It acts as an asphyxiating gas, displacing oxygen in the lungs and making breathing difficult. Propane primarily affects the respiratory, nervous, and cardiovascular systems [5,8]. Although our patient initially exhibited signs of altered consciousness, he became fully alert upon arrival in the emergency department, with a Glasgow Coma Scale (GCS) score of 15/15. While his cardiac enzyme levels were not significantly elevated at first, they increased more than five times the initial results within four hours. Inotropic support was provided as per the pediatric cardiologist's advice, and the patient was admitted to the intensive care unit. Among all the case reports we reviewed; none documented such significant myocardial involvement without evidence of depressed cardiac function on echocardiography due to LPG poisoning.

McKee et al. reported that no toxic effects of the gas were observed at concentrations ranging from 9,000 to 16,000 PPM [2]. Despite this, numerous cases of LPG poisoning have been reported worldwide, with varying findings. Jafar et al. documented two cases of LPG poisoning in children, both presenting with reduced levels of consciousness and convulsions [1]. Godani et al. reported a case involving a 38-year-old prisoner who developed ataxia and Parkinsonism following intentional inhalation of LPG [9]. Prasad et al. and Frangides et al. both described instances of acute massive rhabdomyolysis in patients who were accidentally exposed to LPG [8,10].

A cross-sectional descriptive study conducted by Sirdah et al. on workers exposed to LPG demonstrated that the substance affects multiple organs in humans. The study found that workers exposed to LPG had elevated levels of liver enzymes, as well as increased urea, creatinine, and uric acid levels compared to the control group. Additionally, they exhibited higher levels of hemoglobin, platelets, and hematocrit. The LPG workers also reported poorer general health status, including a higher prevalence of chronic diseases, current health problems, and symptoms such as headaches, vertigo, chronic fatigue, pain, itchy eyes, and skin rashes. Furthermore, they experienced more respiratory issues, including cough, shortness of breath, and frequent sneezing, in comparison to the control group [11].

During our literature search, we did not find any original studies or case reports on propane poisoning and its effects in children below adolescent age. There are a few case reports related to gas poisoning from a substance associated with propane, namely butane (which is also a component of LPG). Unlike our case, almost all of these reports documented arrhythmias in adolescents exposed to butane (table 1). Sen et al. reported a case of ventricular fibrillation in an 18-year-old male who inhaled a combination of gases primarily containing butane [12]. Pamuk et al. described a case of butane inhalation in a 14-year-old male who presented with ventricular fibrillation and elevated troponin I levels, with echocardiography revealing left ventricular systolic dysfunction [13]. In contrast, our patient exhibited elevated troponin I levels but did not present with any cardiac arrhythmias or compromised cardiac function, either in the emergency department or during the inpatient stay and was discharged home in good condition.

CONCLUSION

We concluded that all children exposed to LPG should be admitted to higher-level care units, with serial monitoring of cardiac enzymes, electrocardiograms, and electrocardiographs performed. Although initial tests may appear normal, they can become abnormal within hours. These patients may develop lethal arrhythmias and cardiac dysfunction.

Ethics approval: This case report was approved by the Ethical Review Committee of Aga Khan University Hospital

Table 1. Different Studies Showing the Effects of Liquefied Petroleum Gas Toxicity

Study	Study type	Number of patients	Demographics of patient/s	Clinical presentation	Laboratory findings	Outcome
Jafar et al.[1]	Case report	Two (siblings)	Five-years-old girl and two-years-old brother	Convulsion and altered level of consciousness	Slightly elevated AST, normal ECG and other work up.	Both siblings improved within 24 hours.
Sen et al.[12]	Case report	One	18 years old male	Ventricular fibrillation. Resuscitation was done for 30 minutes followed by intubation before patient landed in emergency.	Echocardiography showed global hypokinesia of the left ventricle (ejection fraction: 50%). The CT scan of the brain and chest radiography showed mild edema	The patient was discharged after two weeks of treatment but resumed normal activities after three months.
Pamuk et al.[13]	Case report	One	14 years old male	ventricular fibrillation diagnosed and resuscitation (for 15 minutes) and intubation was done by ambulance staff before patient landed in emergency	Elevated levels of troponin I, pro-BNP and creatinine kinase. Echocardiography showing left ventricular systolic dysfunction.	Patient expired on 13th day of admission secondary to neurological insult.
Godani et al.[9]	Case report	One	38 years old prisoner	ataxia and Parkinsonism	ECG normal, urine for toxicology negative. Brain MRI showed isolated bilateral lesions involving the caudate nucleus and globus pallidus, as well as diffuse signal alterations in both cerebellar hemispheres	Progressive development of stiffness and bradykinesia, followed by dysarthria, leading to an inability to walk within one year after the event.
Sirdah et, al.[11]	Cross-sectional descriptive comparative study**	30 workers in LPG filling station and 30 healthy individuals as control group	Age more than or equal to 21 years	Poor general health and more respiratory problems as compared to control group	High levels of liver enzymes, and higher urea, creatinine, and uric acid levels. Higher hemoglobin, platelets, and hematocrit	Workers handling LPG as fillers or car distributors are at higher risk of developing health-related symptoms and clinical abnormalities.

*Ages of the patients and further description not mentioned in the free access abstract.
** The inclusion criteria for the study group were age 21 years or older, working at an LPG filling station for at least 6 hours per day for more than 3 years, and no prior history of respiratory disease.

and was assigned approval number 2024-9621-27666. Informed consent in the local language was obtained from the parents after explaining the purpose of the study.

Conflict of interests: The authors declare that they have no competing interests.

Funding: No institutional or external funding was provided for this study.

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