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Five-year epidemiology of liquefied petroleum gas-related burns

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ABSTRACT

Background: The incidence of liquefied petroleum gas (LPG)-related burns has increased over recent years, and it has become a serious public health issue in developing countries such as India and Turkey. This paper aims to investigate the epidemiological characteristics of LPG-related burns to provide assistance and suggestions for planning prevention strategies.

Methods: A 5-year retrospective study was conducted in patients with LPG-related burns admitted to the Department of Burns & Wound Care Center, Second Affiliated Hospital of Zhejiang University, College of Medicine, between 1st January 2011 and 31st December 2015. Information obtained for each patient included age, gender, education status, occupation, medical insurance, average hospital cost, length of hospital stay, monthly distribution of incidence, place of burns, mechanism of burns, extent of burns, site of burns, accompanying injuries, and treatment outcomes.

Results: For the first 4 years (2011–2014), the yearly incidence of LPG-related burns was at approximately 10% of all burns; however, in the fifth year (2015) alone, there was a surge to 26.94%. A total of 1337 burn patients were admitted during this period. Of these, 195 patients were admitted because of 169 LPG-related accidents; there were 11 accidents involving more than one victim. LPG-related burns occurred most frequently in patients aged 21–60 years (73.85%). The majority of injuries occurred from May to August (56.41%), and the most common place was home (83.08%, 162 patients). Gas leak (81.03%) was the main cause of LPG-related burns, followed by inappropriate operation (7.69%) and cooking negligence (2.05%). The mean burn area was $31.32 \pm 25.40\%$ of TBSA. The most common sites of burns were the upper extremities (37.47%), followed by the head/face and neck (24.80%) and lower extremities (19.95%). The most common accompanying injuries included inhalation injury (23.59%), shock (8.71%), and external injury (7.18%). The average hospital stay was 22.90 ± 19.47 days (range 2–84 days). Only 48 patients (24.62%) had medical insurance, while 124 patients (63.59%) had no medical insurance. The average hospital cost of the no medical insurance group was significantly higher ($p < 0.0001$) than that of the medical insurance group. In addition, 72.73% of patients who left against medical advice (LAMA) were uninsured. The number of patients who recovered at our hospital was 165 (84.62%), while 22 patients (11.28%) LAMA. The overall mortality rate was 4.10% (8 patients).

Conclusion: Our study shows that the exponential increase in LPG-related burns is alarming. This calls for rigorous precautions. Because gas leak was the main cause of LPG-related burns,

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any part of LPG stove system that shows signs of weathering should be replaced regularly. In addition, we also found that most of the LAMA patients were uninsured. Thus, comprehensive medical insurance should be involved early in the recovery process to assure a safe and adequate discharge.

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1. Introduction

Liquefied petroleum gas (LPG) is a clean fuel that is widely used for domestic purposes in developing countries such as China and India [1]. In 2005, China and India accounted for more than 20% of the world's residential-commercial LPG consumption, and domestic LPG use was as high as 30% in China [2,3]. Hence, the incidence of LPG-related burns has increased over recent years. A previous study reported that LPG-related accidents increased from 10.7% of all kitchen accidents (2001-2007) to 20.2% (2009-2010) in India [4]. In addition, it has become an enormous public health issue as it can injure more than one victim in a single accident.

Although other countries have reported increases in LPG burns [1,2,4], few studies in China exist. Therefore, it is imperative to study the profile and incidence of LPG-related burns in China. Our study aims to represent the epidemiological characteristics of LPG-related burns and their probable risk factors. This may be useful for revealing the potential danger of LPG-related accidents and providing suggestions for planning prevention strategies.

2. Material and methods

A 5-year retrospective study was conducted in the Department of Burns & Wound Care Center, Second Affiliated Hospital of Zhejiang University, College of Medicine, China. This burn unit consists of a 38-bed general ward and a 9-bed burn intensive care room, and it is the burn-training center for almost all the burn surgeons and nurses in the Zhejiang Province.

Patient data was collected from the clinical database of patients with LPG-related burns between 1st January 2011 and 31st December 2015. The following data were recorded in Microsoft Excel and analyzed using SPSS version 19 by t-test or one-way ANOVA. A p value of <0.05 was considered statistically significant.

1. Age: As an institutional policy, burn patients admitted to our burn center are mostly older than 15 years. There are

only a few patients below the age of 15 years who are admitted to our unit occasionally; most of these patients are referred to the burn unit at the pediatric hospital.

2. Gender.
3. Educational status: Illiterate, primary school/junior high school/senior high school/college, or higher qualifications.
4. Occupation: Worker/farmer/cook, etc.
5. Medical insurance and average hospital cost.
6. Length of hospital stay and monthly distribution of incidence.
7. Place of burns: Home/workplace/restaurant/others.
8. Mechanism of burns: Gas leak/inappropriate operation/cylinder blast/epileptic attack/cooking negligence/suicide. Inappropriate operation was mainly related to the handling of gas stove or replacing the gas cylinder. Cooking negligence included placing flammable material close to the stove or not attending by the fire.
9. Extent of burns: As seen in Table 1, the severity of burns was classified into four groups: mild, moderate, severe, and extremely severe according to the standard that was set at the Chinese National Burn Conference in 1970 [5].
10. Sites of burns: Head and neck/upper extremities/trunk/lower extremities, etc.
11. Accompanying injuries: Inhalation injury/shock/external injury.
12. Treatment outcome: Recovered/left against medical advice (LAMA)/died.

3. Result

A total of 1337 burn patients were admitted during this period. Of these, 196 patients suffered from LPG-related accidents, which formed 14.66% of all burn patients. One patient was excluded from the study because of the lack of data integrity. Over the 5-year period, the incidence of LPG-related burns showed an increasing tendency. For the first 4 years (2011-2014), the yearly incidence was at approximately 10% of all burns; however, in the fifth year (2015) alone, there was a surge to 26.94% (Table 2).

Table 1 – Classification of burn severity.

| Burn severity | Children | Adult |
|------------------|--|--|
| Mild | <5% TBSA of second-degree burn | ≤10% TBSA of second-degree burn |
| Moderate | 5-15% TBSA or <5% TBSA of third-degree burn | 11-30% TBSA or <10% TBSA of third-degree burn |
| Severe | 16-25% TBSA or 5-10% TBSA of third-degree burn | 31-50% TBSA, 10-20% TBSA of third-degree burn or ≤30% TBSA with severe accompanying injury (e.g., severe trauma, chemical poisoning, or inhalation injury) |
| Extremely severe | >25% TBSA or >10% TBSA of third-degree burn | >50% TBSA or >20% TBSA of third-degree burn |

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