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## Ten-year epidemiology of chemical burns in western Zhejiang Province, China



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### ABSTRACT

**Background:** Chemical burns occur frequently in western Zhejiang Province. This study documents the epidemiology of chemical burns in the region using burn data from a local specialized hospital. Results from this analysis will assist in the planning of prevention strategies for high-risk occupations and groups.

**Methods:** A 10-year retrospective analysis was conducted for all patients with chemical burns admitted to the Department of Burn and Plastic Surgery from January 2004 to December 2013. Information obtained for each patient included demographics (gender, age, occupation and education), location of the burn, cause of the burn, and categories of chemicals. Data regarding the season of admittance, prehospital treatment, wound site/size (area, region, and depth), accompanying injuries, operations, length of hospital stay and mortality were also assessed.

**Results:** A total of 690 patients (619 males, 71 females; average age:  $30.6 \pm 12.4$  years) were admitted to the department for chemical burns. Over the 10-year period, the incidence of chemical burns showed an increasing tendency. Chemical burns occurred most frequently in patients aged 20–59 years (94.79%). Most of the chemical burns were work-related, primarily in private enterprises (47.97%) and state-owned enterprises (24.93%). Operations (68.99%) and machine problems (17.26%) were the main causes of chemical burns in the workplace. With regard to burns caused by chemicals, most were caused by acids (72.01%), with hydrofluoric acid and sulphuric acid causing 51.45%. Most chemical burns occurred in the summer and autumn seasons (61.02%). The burn size was <10% of the total body surface area (TBSA) for 445 patients (64.49%), while only 26 patients (3.76%) had burns covering >40% TBSA. The most common burn sites were the upper extremities (31.57%), lower extremities (19.86%), and head and neck (28.83%). Most patients (581 (84.20%)) received water washing treatment on site immediately after exposure. The most common accompanying injuries included inhalation injury, ocular burns and digestive tract injury. The average hospital stay was  $17.0 \pm 23.1$  days (range 1–333 days). Surgery was performed in 146 patients (21.16%), and the overall mortality rate was 0.58%.

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**Conclusions:** Chemical burns are preventable. The high morbidity of chemical burns in western Zhejiang Province is related to the industrial structure of the area. Governmental management in the fields of production, transportation, and utilization of chemicals could be improved. Workplaces have the responsibility to provide safe work environments and equipment, as well as occupational education and safety training for high-risk work groups.

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## 1. Introduction

Chemical burns, after thermal burns, are the second most common cause of burns in China [1,2]. A wide variety of chemicals have the potential to cause tissue injuries and systemic effects [3,4]. Although many strategies have been developed for prehospital decontamination [5,6], wound management and systemic support [3,7], prevention remains the best way to avoid recurrence of these accidents and injuries.

The etiology and morbidity of chemical burns varies around the world, influenced by the local population structure, industry distribution, and geographical and social environments [8,9]. Epidemiologic studies can provide reliable data to help with the initiation and assessment of effective preventive approaches. Zhejiang province, located in the southeast coast of China, is well-known for its rapid economic development and industrialization level [10]. The chemical industry is considered an important pillar industry in the area, particularly in the western part of the province. In recent years, large chemical corporations, as well as private enterprises and sole proprietorships, have continued to expand their plants and increase production. The usage of chemicals is high in the production industry, transportation and domestic life, partly due to the thriving development of private and collective enterprises. The related occupational education and safety training are lacking, and thus, workers may fail to follow safety rules and regulations. This lack of safety education combined with the high usage of chemicals leads to a high frequency of chemical injuries, which may occur as sporadic cases or as group events injuring multiple people [11]. The Quhua Hospital is a medical institute focusing on the treatment and management of chemical burns in western Zhejiang Province. This study presents the epidemiologic characteristics of 690 patients with chemical burns admitted to the Quhua Hospital between January 2004 and December 2013.

## 2. Materials and methods

The Quhua Hospital is the largest chemical burn center in western Zhejiang Province, with 38 beds and eight ICU beds. The burn center provides high-quality medical care for patients with chemical burns, thermal burns, and other types of burns and trauma. Clinical data were collected from 3702 consecutive patients with burns admitted to the Quhua Hospital from January 2004 to December 2013. Of these, 690

patients (18.64%) suffered from chemical burns. This study retrospectively analyzed the 690 chemical burn cases with regard to patient demographics (gender, age, occupation and education), location of burn, cause of burn, and chemical category. The season of admittance, prehospital treatment, wound site/size (area, region, and depth), accompanying injuries, operations, length of hospital stay and mortality were also assessed.

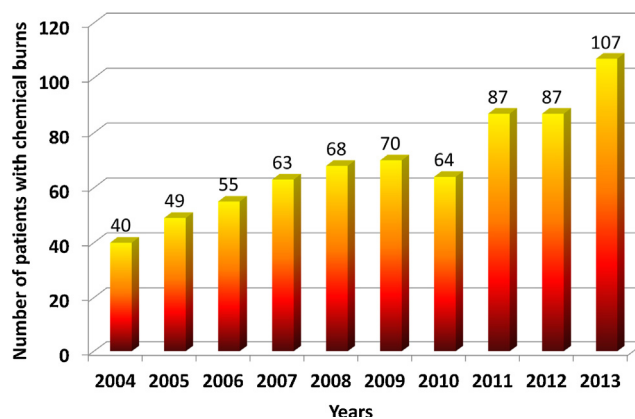
## 3. Results

### 3.1. Tendency of chemical burns

Fig. 1 presents the number of patients admitted each year for chemical burns. The incidence increased gradually over the 10-year period, although a slight fluctuation in this trend was observed in 2010.

### 3.2. Basic demographic characteristics

Of the 690 patients, 619 were male and 71 female (a ratio of 8.72:1). The average age was  $30.6 \pm 12.4$  years, ranging from 6 months to 79 years. Chemical burns occurred most frequently in patients aged 30–49 years (67.25%), followed by those aged 50–59 years and 20–29 years (Table 1). The occupations of the patients are listed in Table 2. Workers accounted for the majority (76.23%), followed by farmers (11.30%), citizens (6.23%), and students (1.59%). Workers were more often from private enterprises (47.97%) and state-owned enterprises (24.93%) than from joint venture or overseas-funded enterprises (3.33%). In terms of education level, most patients had



**Fig. 1 – The number of chemical burns from January 2004 to December 2013.**

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