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Epidemiological trends and risk factors in major burns patients in South Korea: A 10-year experience

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ABSTRACT

Purpose: To determine epidemiological trends among burns patients admitted to our burns center during 2003–2012, and the usefulness of the Abbreviated Burns Severity Index (ABSI) for predicting burns-related mortality.

Methods: We retrospectively reviewed the data of 4481 burns patients. We analyzed the epidemiological trends and ABSI scores using Student t-test and one-way analysis of variance (continuous variables), chi-square test (categorical variables) and stepwise logistic-regression analysis (predictors of mortality).

Results: The mean age and male-to-female ratio were 39.9 ± 19.7 years and 2.88, respectively. ABSI scores decreased from 7.7 ± 3.0 in 2003 to 6.9 ± 3.0 in 2012. Mortality rate improved from 24.5% in 2003 to 15.8% in 2012. Burns were caused by flames (67.3%), scalding (22.0%) and electrical (7.5%), chemical (1.6%) and contact (1.5%) injuries. Scalding and flames were the most common causes in patients aged ≤ 20 years and ≥ 21 years, respectively. Female sex, inhalation injury, full-thickness burns, large total body surface area (TBSA) burned and old age predicted mortality. ABSI scores < 4 and > 14 were associated with 0.7% and $> 90\%$ mortality, respectively.

Conclusions: The mortality of major burns has decreased but remains high. ABSI scores predict burns-related mortality.

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Abbreviations: ABSI, Abbreviated Burn Severity Index; BICU, burn intensive care unit; TBSA, total body surface area.

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1. Introduction

Burns are life-threatening and have varying morbidity and mortality rates in different countries. In 2000, an estimated 238,000 people worldwide died of burns. Over 95% of lethal burn victims are from low- and middle-income countries [1]. In South Korea, annual fire accidents increased from 31,372 in 2003 to 49,631 in 2008, and decreased to 47,318 and 41,868 in 2012 and 2013, respectively. The mortality rates of burns have decreased with advancements in antibiotics, nutritional support, critical care and skin substitutes in the last few decades, but are nevertheless high [2]. Burns constitute a national health problem because of the associated morbidity, rehabilitation, mortality and requirement of high cost medical services. Prevention is generally the best method of reducing the incidence and mortality rates of burns. The first step in burn prevention is the identification of the various epidemiological parameters related to burns and treatment outcomes. Although many severity scoring models have been proposed for the prediction of the mortality of thermal injuries, only eight have been constructed using appropriate methodological standards [3]. One such model is the Abbreviated Burn Severity Index (ABSI), which consists of five variables: gender, age, presence of inhalation injury, presence of full-thickness burns and percentage of total body surface area (TBSA) burned [4]. The aims of our study are to analyze the epidemiological characteristics, trends and risk factors of major burns and to confirm the efficacy of the ABSI as a scoring system for predicting the outcomes of burns patients.

2. Patients and methods

2.1. Burn Center, Hangang Sacred Heart Hospital, Hallym University

Burn Center at Hangang Sacred Heart Hospital is the largest burns center in East Asia. The center consists of 250 burn-related beds, 18 burn intensive care units (BICUs), treatment and operating rooms and advanced equipment, including silicon beds and sterilized water-treatment machines. The burns center employs medical professionals in burns surgery, plastic surgery, rehabilitation, psychiatry and internal medicine. The highly coordinated team provides burns patients with excellent and customized medical care, covering the whole process of diagnosis, surgery, treatment, rehabilitation and reconstruction.

2.2. Patient selection

This study was approved by institutional review board of Hangang Sacred Heart Hospital. The study group consisted of 4481 major burns patients who were admitted to the BICUs of Hallym Burn Center at Hangang Sacred Heart Hospital between January 2003 and December 2012. We retrospectively reviewed the medical records of these patients. The criteria for admission to the BICUs were as follows: $\geq 20\%$ TBSA burned or $\geq 10\%$ TBSA burned in children aged < 10 years and adults aged > 60 years, full-thickness burns of $\geq 10\%$ TBSA, all burns

involving the eyes, ears, face, hands, feet or perineum that were likely to result in cosmetic or functional impairment, all high-voltage electrical burns, all burns complicated by major trauma or inhalation injury and all poor-risk patients with burns. In this study, we defined major burns patients as those who were admitted to the BICU. Thus, no patients were excluded.

2.3. Medical record review

We recorded the following variables for each patient: age, gender, type of burns, extent of burns and presence of full-thickness burns and inhalation injury. The ABSI score was calculated by assigning a numerical value to the variables age, gender, extent of burns, presence of full-thickness burns and presence of inhalation injury depending on their severity and then adding all five values. The extent of burns was measured by an expert burns surgeon using a modified Lund and Browder chart [5]. The presence of inhalation injury was confirmed by bronchoscopy within 2 days after admission. Bronchoscopy was performed on intubated patients who were suspected to have an inhalation injury owing to physical findings such as singed facial hair, carbonaceous deposits in the oropharynx or sputum, facial burns and voice change.

2.4. Statistical analysis

Statistical analyses were conducted using SPSS 17.0 for Windows. All continuous variables were presented as means \pm SD, and the frequencies of categorical variables were presented as percentages. Continuous variables were analyzed with the Student t-test or one-way analysis of variance when appropriate. Categorical variables were analyzed with the chi-square test. Stepwise logistic-regression analysis was performed to evaluate the risk factors of burns-related mortality. A probability value of < 0.05 was considered statistically significant.

3. Results

3.1. Epidemiological characteristics and trends in major burns patients

Table 1 shows the epidemiological characteristics and trends in major burns patients. Between 2003 and 2012, 4481 burns patients were admitted to our BICUs. The total number of burns patients admitted to the BICUs in each year showed a decreasing trend until 2010, and slightly increased thereafter (2003: 548 patients, 2012: 412 patients). The mean age of all the patients was 39.9 ± 19.7 years. The mean age increased by approximately 3 years from 2003 to 2012. A male preponderance was noted in the study group, with the male-to-female ratio being 2.88. The mean TBSA burned and mean TBSA showing full-thickness burns were $35.1\% \pm 24.4\%$ and $20.6\% \pm 25.6\%$, respectively. Both variables showed a tendency to decline during the study period. The number of patients with full-thickness burns was 3082 (68.8%).

Bronchoscopy revealed that 1291 patients (28.8%) had inhalation injuries. The incidence of inhalation injuries

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