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Genital burns in the United States: Disproportionate prevalence in the pediatric population

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ABSTRACT

Introduction and objectives: To describe the epidemiology of genital burns in the U.S. and investigate the underlying etiology.

Methods: The National Electronic Injury Surveillance System database was queried for individuals who sustained genital burns from 2000 to 2016. We collected data on age, gender, injury diagnosis, disposition, and causative agents. Multivariate analysis was performed to determine predictors of hospitalization.

Results: We estimate 17,026 (95% CI 16,649–17,404) cases of genital burns presented to emergency departments nationally. Genital burns occurred more in males than females (12,295 vs 4,731). Scalding (57.9%) was the most common mechanism of injury and hot water (35.7%) the most common causative agent. Significant predictors of hospitalization on multivariate analysis were multi-surface (OR 4.4), scalding (OR 11.5) and thermal burns (OR 27.9).

Children ages 0–2 had the highest prevalence of genital burns, and children ages 0–12 comprised 37.1% of the study. For children <5 years of age, majority of the burns were caused by hot water in the bathroom. In age group 6–12, the most common causes of genital burns were cooking-related scalds due to hot foods and water.

Conclusions: Children sustain genital burns at a higher rate than adults and many appear to have a preventable mechanism. Improved product design for safety and educating caregivers about potential hazardous situations are needed.

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1. Introduction

Burns are an uncommon source of injury to the genitalia and perineum but can have debilitating physical, psychological

and reproductive consequences. Certain characteristics of male and female genitalia provide capacity to resist injuries. Anatomic location of the perineum as well as coverage by clothing make the exposure to the causative agents less probable [1–3].

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Burns to the genitalia and perineum are classified as major burns by the American Burn Association [4]. Single-institution studies have estimated the prevalence of genital burns (GB) between 1.7%–13% of burn hospital admissions [5–7]. Individuals with GBs are more likely to have higher total body surface area (TBSA) involvement; genitalia alone comprise 1% of TBSA and studies have demonstrated an average TBSA of 21%–56% for all patients with perineal burns [5]. They additionally have increased rates of mortality and hospital acquired infections [5,6]. Urinary tract infections and bacteremia are significantly more common in GB victims [6,8]. After controlling for age, ethnicity, TBSA, inhalation injury and burn depth, GBs remain a strong predictor of mortality [6].

Despite their importance, the medical literature on GBs is sparse. To our knowledge no descriptive epidemiological study on GBs have been published in the literature. The objective of the current study is to describe the epidemiology of GBs using a nationally representative sample of individuals presenting to emergency departments (ED) in the United States. Secondary aims are to investigate the underlying etiology and causative agents in order to promote prevention and influence care for these individuals in the future.

2. Methods

2.1. Study Population

The National Electronic Injury Surveillance System (NEISS) is collected from 100 EDs each year in the United States. Operated by the US Consumer Products Safety Commission, data collection and analysis is performed on a daily basis at NEISS ED hospitals by NEISS hospital coordinators. The data collected is a stratified probability sample used to produce national estimates of US ED patients. These ED hospitals are categorized based on five strata, four based on size and the fifth consisting of children's hospitals. The non-children's hospitals are stratified based on annual number of ED visits: small, medium, large and very large. Additionally, they consist of large inner-city hospitals with trauma centers, urban, suburban and rural hospitals. The data collected includes the individuals' age, gender, injury diagnosis, product codes and the affected body part. A brief narrative of the injury is included [9]. For the purpose of this study, the NEISS database was queried for individuals who sustained all cause diagnosis of burns to the pubic region, lower trunk, upper leg and all of body from the year 2000–2016 in order to capture all injuries that involved the genitalia. The coded data was read using the NEISS Coding Manual and Product Code Comparability Table issued in January of 2017 [10,11].

2.2. Variables

Burns were grouped into three categories: scalding, chemical and thermal (codes: 48, 49, 51). As defined by the NEISS coding manual, scalding is a burn caused by hot liquid or steam, chemical burns are caused by acids or alkalis, and thermal burns are caused by flames or hot surfaces [11]. Although defined as such by NEISS, thermal burns are formally defined as a tissue injury due to application of heat

in any form to the body surfaces. Scalding burns therefore are a subset of thermal burns and will be referred to as such in this paper. These three categories were then further split into twelve classifications to identify causative agents: hot water, hot beverages, chemical cleaners, hot food, fire, hot surfaces, flammable chemicals, unknown chemicals, battery/acid, fireworks, oils, and cigarettes. Each narrative was examined to see if injuries were isolated to the genitals alone or multiple regions of the body. Injuries were categorized by anatomic location of each sex: penis, scrotum, perianal and multiple areas for males and vulva/vagina, perianal and multiple areas for females. While anatomically distinct, vulva/vagina were used interchangeably in the narrative, which is why they were classified together. Age was categorized into the following groups: 0–1, 2–5, 6–12, 13–17, 18–30, 31–45, 46–65 and 66+. Disposition was defined as: treated and released, transferred, hospitalized, left against medical advice, held for observation, Dead on arrival/died in ER and unknown. Injury locations included: home, unknown, public, school, place of recreation or sport, street and mobile home.

2.3. Statistical analysis

All data was analyzed using Stata v.13 (StataCorp LP, College Station, TX, USA). We used descriptive statistics to summarize the study population from all years. We used the NEISS complex sample design to calculate projections of absolute number of GB cases. We then divided the estimated frequency of GB cases by the US census population totals to produce incidence per 1,000,000 [12]. We performed logistic regression analysis to determine predictors of hospitalization from GBs. In the analysis of predictors of hospitalization, hospitalized and transferred patients were combined together as they both demonstrate more severe injuries. All p-values (two-sided) less than 0.05 were considered statistically significant.

3. Results

3.1. Demographic characteristics

In the 17-year (2000–2016) study period, the weighted national frequency of all cause GBs was 17,026 (95% CI 16,649–17,404) with an average yearly incidence of 3.27 cases per million (Table 1). The demographic characteristics are summarized in Table 2. The mean age at the time of injury was 26.5 years (SD 21.7, range 1 month–96 years). The mean age of the pediatric and adult populations was 6.2 (SD 4.9) and 41.8 (SD 16.2). Fig. 1 presents the prevalence of GBs for each individual age. The prevalence of GBs for ages 0–2 are the highest and noticeably decline after the age of 70. Children ages 0–12 comprised 37.1% of the study population. GBs occurred more commonly in males than females (12,295 vs 4,731 respectively) but males were at decreased odds for hospitalization (OR 0.5, 95% CI 0.28–0.89, $p=0.02$). Of those injured 66.5% were treated as an outpatient, 21.7% were transferred, and 9.1% were admitted. Most injuries occurred at home and involved multiple areas of the external genitalia.

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