

Children's scalds from tearing of hot water bottle

Quemaduras en niños provocadas por rotura de bolsa para agua caliente

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Abstract

Introduction: Children scalded by the tearing of hot-water bottles presented a sudden and significant increase around 2000 in Chile. For this reason the Aid to Burned Children Corporation (COANIQUEM) publicized prevention concepts concerning the careful use of this device and raised a voice of alarm to authorities. Later, the National Normalization Institute introduced quality certification standards for hot water bottles sold in the country. **Objectives:** Determine the impact of preventive measures and quality certification for hot water bottles in burns caused by tearing of the device on children. **Patients and method:** Review of 795 patients under 15 admitted with injuries caused by hot-water bottle rupture between 2000 and 2014 at COANIQUEM Santiago. The frequency of burns by the ethiological agent is determined and the epidemiological profile are compared in the initial and final quinquennial period. **Results:** Between 2000-2004, an increase of 272.7% was recorded and then a decrease of 81.3 % was found between 2005-2014. Demographic characteristics, month of occurrence and need of some kind of surgery were similar in both periods. The number of locations and injuries diminished, and are concentrated in one burn (77.8%). In the first period the main anatomical region affected was lower limbs and in the second period abdominal and pelvis are also frequent. **Conclusions:** An important decrease of burns by hot-water bottle rupture with significant changes in their epidemiological characteristic is verified. This coincides with preventive measures and manufacturing standards regulations and quality control.

Keywords:

Hot water bottle,
burn,
children

Introduction

The bottle of hot water made of rubber or vinyl polychloride (PVC), denominated “*guateros*” (hottie) in Chile, are domestically used in many countries for the winter season as a traditional form of warming a bed, as a complement or in absence of heating systems within the house. The fluid spillage at the filling moment or by prolonged contact with the same area of the skin can occasionally cause burns. However, the secondary damage caused by the tearing due to the product quality is little known.

In the Corporation for Assistance of Burned Children (COANIQUEM) in Santiago, patients are attended on an outpatient basis, as long as the total body surface area compromise is less than 5%, executing skin grafts if necessary due to the lesion depth. Additionally, patients that were inpatient in other institutions due to more extensive burns and patients referred from different parts of the country are received for the rehabilitation of their burn scars, therefore the number of admissions exceeds 3000 per year. This allows us to have a general appreciation of the epidemiology of the children’s burns and detect the appearance or variation of different mechanisms that produce burns, considering studies related to burns caused by fireworks, the overturn of the pot with boiling water upon the kitchen, and the overturn of a cup of tea, among others, had been carried out¹⁻³. In 2001, during a revision of the registration of the children admitted of the commune of Pudahuel were identified different mechanisms that provoke burns as the overturn of a cup, a pot, a kettle, and the contact with an iron or heater, but burns caused by hot water bottles were not detected⁴. Nevertheless, in 1999, in the same institution, it was found that from other places in the Metropolitan Region children with lesions secondary to the tearing of the hot water bottle, which occurred soon after going to bed, were admitted. This was provoked when the child moves the element with his feet or presses it with the trunk. It drew attention that the bottles were bought few days before, which was unusual back then; this led the institution to identify and register this mechanism in the admissions for making a follow-up of this situation. Subsequently, after noting the sustained increasing tendency was consistent with the massive import of products from abroad, taking advantage of new policies with customs duty concessions, it was communicated the fact to the authorities of Ministry of Health and Chile’s National Consumer Service (SERNAC) as well as to the importers and distributors of this type of products, in order to make an attempt to monitor the quality of the elements that were being commercialized. At the same time, the means of com-

munication spread this risk to warn the population.

In July 2004, SERNAC informed that in an evaluation carried out in these products, in 50% of the brands analyzed of elements that were sold in the Metropolitan Region were found resistance defects of joints of the bottle edges and labeling. The technical analysis of laboratory considered in its trials physical and mechanic variables at the moment of analyzing the samples of hot water bottle, for example, thickness, traction, deformation, closures, tear, filtration, pressure, among others⁵. A technical commission convened by National Standard Institute, where COANIQUEM participated, recognized the hot water bottle potential as a source of major burns in the population. As a consequence, Ministry of Economy, Development, and Reconstruction dictated Exempt resolution N°. 445 in 2005, where were established the standards NCh2953Of2005, laying down the security and manufacturing requirements of the hot water bottles made of rubber or PVC⁶. These standards, although the compliance with this is a voluntary commitment, are followed by most of the manufacturers and importers of products to prevent complaints from the consumer due to the defects of the product after selling. Once identified this new specific mechanism that provokes burns in children and established the minimum quality standards for providing more security in the use of these heating elements, it was considered convenient to know the variance of its impact in time and its characteristics. Considering the exposed backgrounds, it was established, as the aim of the study, to determine the impact of preventing and quality certification measures of hot water bottles in burns caused by the tearing of the product in children.

Patients and Method

Patients

A retrospective, descriptive study based on the revision of database of admission of 795 children with burns caused by the tearing of hot water bottle, between 2000 and 2014, proportionately by Coordination of Patients Care Department of COANIQUEM in Santiago de Chile⁷.

Data analysis

The database was entered onto an Excel spreadsheet, replacing the name of the patient with a code, and personal identification data was not included. Under these premises, the work counted on the authorization of institutions directives.

The data were processed with SPSS v16.0. The periods of 2001-2004 and 2011-2014 were selected as a way to reduce annual random variations of the number of admissions and compare demographic and epi-

demiological variables between both periods, under the assumption of possible changes in the profile of the children that used the hot water bottle in these extreme periods of the series. In order to determine the statistical significance of the changes, it was used the test of the difference between proportions based on normal distribution with $p < 0.05$.

Results

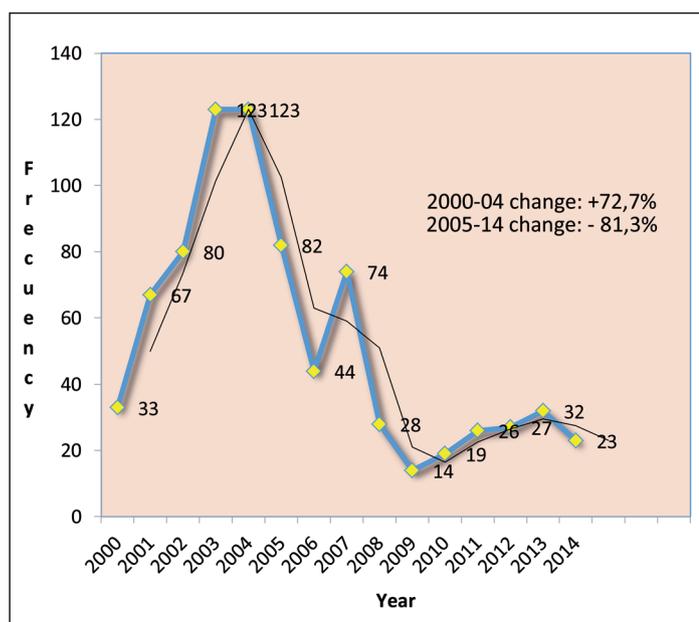


Figure 1. Children burned by hot water bottle tearing. COANIQUEM. 2000-2014.

Table 1. Demographic characteristics of children burned by hot water bottle tearing. Comparison between 2001-2004 and 2011-2014 periods

| Characteristic | 2001-2004 | | 2011-2014 | | p-value |
|--------------------|---------------|-------|---------------|-------|---------|
| | n | % | n | % | |
| Total | 334 | 100.0 | 108 | 100.0 | |
| Sex | | | | | |
| Female | 172 | 51.5 | 58 | 53.7 | 0.6898 |
| Male | 162 | 48.5 | 50 | 46.3 | |
| Age (years) | | | | | |
| < 5 | 54 | 16.2 | 28 | 25.9 | 0.069 |
| 5-9 | 155 | 46.4 | 42 | 38.9 | |
| 10-14 | 125 | 37.4 | 38 | 35.2 | |
| Average \pm DS | 8.5 \pm 3.4 | | 7.8 \pm 3.9 | | |
| Regional residence | | | | | |
| Metropolitan | 317 | 94.9 | 100 | 92.6 | 0.3647 |
| Other | 17 | 5.1 | 8 | 7.4 | |

In graphic 1, it is showed the evolution of 795 admissions due to burns caused by the tearing of hot water bottle in the 15 years of studied period. Considering year 2000 as basal, a strong growing is distinguished between 2000-2004 (+272.7%) and then a marked decline from 2005 to 2014 (81.3%) with a posterior stabilization.

The demographic characteristics did not present significant variation in the comparison of both periods, there is a greater proportion of female patients, the group from 5 to 9 years of age is the one with greater concentration of burns caused by the tearing of hot water bottle and mostly the patients attended in COANIQUEM are domiciled in the metropolitan region (Table 1).

It was observed that in the cold months from May to August, the greater occurrence of burns caused by the tearing of hot water bottle in children (80% and more) is concentrate and the hourly period of higher frequency is at bedtime between 19 and 24 hours. The proportion of the localization of burns in compared periods has decreased, concentrating mostly in a single lesion (77.8%), which results to be statistically significant. The lower limb, left or right, is the one that get largely burned with this accessory, but there has been an increase from 3.6% to 19.4% for the abdomen and pelvis, a significant change for the localization of this lesion. 1/7 of sufferers required some type of surgery (Table 2).

Discussion

The use of hot water bottle poses the threat of causing burns secondary to heat. Apart from its use as a heating element, it is used as analgesia of abdominal, lumbar, and limbs discomfort. It is known that, when you keep them in the bed, it may lead to an implicit risk of burns by contact in patients with sensitivity disorders due to medullary lesions or peripheral neuropathies, in neonates that cannot move, and even in children that experiment a deep sleep and those who do not perceive the pain on sustained contact with a bottle that can maintain temperatures over 122°F (50°C) for a long period. Lesions can also be produced by carelessness when pouring the liquid to the bottle or misplacing the closing cap.

There is a lack of researches on incidence, causality, and results of burns of any type due to the use of the hot water bottle. Globally, the largest number of published cases corresponds to a retrospective study in Shanghai, China⁸, where 294 cases of inpatients were recorded between 1992 and 2011 among which 39 (13.3%) were in children under 15 years old. Out of 294 patients, 79.6% was due to contact, 18.4% was

Table 2. Epidemiological characteristics of children burned by hot water bottle tearing. Comparison between 2001-2004 and 2011-2014 periods

| Characteristic | 2001-2004 | | 2011-2014 | | p-value |
|-----------------------|-----------|-------|-----------|-------|-----------|
| | n | % | n | % | |
| Total | 334 | 100.0 | 108 | 100.0 | |
| Burn occurrence month | | | | | |
| january-april | 13 | 3.9 | 5 | 4.6 | 0.6262 |
| may-august | 279 | 83.5 | 93 | 86.1 | |
| september-december | 42 | 12.6 | 10 | 9.3 | |
| Hourly period** | | | | | |
| 01-06 | 13 | 3.9 | 8 | 7.4 | 0.0106* |
| 07-12 | 24 | 7.2 | 9 | 8.3 | |
| 13-18 | 17 | 5.1 | 10 | 9.3 | |
| 19-24 | 271 | 81.1 | 60 | 55.6 | |
| no data | 9 | 2.7 | 21 | 19.4 | |
| Burn location number | | | | | |
| 1 | 190 | 56.9 | 84 | 77.8 | 0.0005* |
| 2 | 116 | 34.7 | 19 | 17.6 | |
| 3 y más | 28 | 8.4 | 5 | 4.6 | |
| Burn location | | | | | |
| lower limb | 302 | 90.4 | 79 | 73.1 | < 0.0001* |
| abdomen and pelvis | 12 | 3.6 | 21 | 19.4 | |
| others*** | 20 | 6.0 | 8 | 7.4 | |
| Surgery | | | | | |
| yes | 52 | 15.6 | 15 | 13.9 | 0.6721 |
| no | 282 | 84.4 | 93 | 86.1 | |

*Significant. **For p-value calculation, no data items were excluded. ***Others included: head and neck, face, upper limb, hand and thorax.

caused by a burn due to the liquid of the bottle, and 2.0% by the steam when pouring the element. In a tertiary health care center, between January 2004 and March 2013, 85 inpatients were identified by burns due to the use of hot water bottle, of which 39 (45.9%) were under the age of 18. In 48.2% of the admissions was found an spontaneous tearing of the bottle or a misuse⁹. In Australia, two retrospective studies between January 1998 and September 1998 and between July 2005-June 2013 reported 33 and 155 cases of inpatients due to burns caused by hot water bottle respectively, with no children under 13 years old. Between 60.9 and 75.4% were lesions caused by the liquid spill through the tearing of the device or the runoff when pouring the bottle^{10,11}. As a consequence of this backgrounds in New Zealand and then in Australia, standards to improve the quality of the hot water bottle that would be commercialized were dictated to decrease the incidence of this mechanism of burns¹⁰. Counting on a systematic database in time is a source of important of information for area specialists. The number of patients detected in COANIQUEM is larger than in other published studies, which could

be explained by the registration of cases of outpatient care with minor lesions depth.

The use of these heating elements, are normally provided by an adult in charge who is also the one that pour the water and put the device on the bed.

The attention of patients that includes referrals from different zones of the city and neighboring regions and contemplates burns of different severity was what allows us to note that there was an emerging mechanism that did not cause such a number of affected.

The identification of this specific mechanism and its registration of admissions of the patients of the institution provided a statistical support of the increase that it was being produced because of this causal mechanism, which reached 272% in 5 years. With this evidence, authorities, traders, and consumers could be warned about the tearing risk of the bottle for taking actions to reverse the situation. The complementary research carried out by the National Consumer Service (SERNAC)⁵ proved that elements of a very different quality were being commercialized and justified the dictation of standards that guarantee the security of the bottle for sale to the general public. The sharp and sus-

tained decline of the number of cases after 2005 would be directly related to the recommended certification for the commercialized elements posteriorly.

The epidemiological data collected are consistent with the preferent use that the hot water bottle received in the cold months and with the fact that most of people that seek medical advice in the institution are from the metropolitan region, place of the country that has very marked the different seasons of the year.

The clinical importance of the lesions originated by the tearing of hot water bottles is shown in the evidence due to the need of performing healing by the specialized personnel for treating people that seek medical advice and 1/7 of cases required surgery to obtain a proper coverage of the affected skin and they need to continue in rehabilitation for their burn scars.

There were no significant changes in age or gender of the people that seek for medical advice in the studied periods. In patient of the last period was a minor number of lesions in the episode, which could be related to the fact that the tearing of the bottles had been of minor size, spilling less liquid, due to the better quality. This can also explain the relative increase of localizations in the abdomen and pelvis because of the crushing of the bottle by the body, in this cases, produces a higher internal pressure that causes the lower limb touch or hit the bottle with an unintentional movement of a foot, and thus the tearing of the element is more feasible.

The decrease of the domination of night-time in this type of burns in the second period, also can be explained because it obtains a major relative importance of the use of heat for different therapeutic purposes to the mere heating of the bed.

We consider successful the actions carried out to decrease this mechanism of burns because of the speed of the effect achieved, and we mainly attribute the better quality of the water bottle commercialized to the improvement of the security conditions of the environment. In the 2005-2014 periods, there was a decrease of the total admissions of any type of burns in the institution from 3.608 to 3.100 (14.1%). Part of this decrease was due to a smaller-than-expected population for that period of 7.3%¹². These figures are far lower to 81.4% registered in the admission by the specific mechanism. The possibility that other factors might have affected the change of preference for the use of hot water bags for others objects-elements such as electric heater for the bed or bags padded with seeds that are heated in a microwave oven, it is estimated as little relevance since there has not been commercial or preventive campaigns in that line.

It is possible that the number of children that still getting burnt with this mechanism corresponds to elements that are sold in the formal trade on an occa-

sional basis¹³ or simply in the informal trade and they do not meet the standards. Therefore, it is convenient to maintain in force the recommendation of verifying that they have the certification seal of meeting standards and renew them every two years. Moreover, it is advisable to fill only 2/3 of the bottle with no freshly boiled water, dump the air before putting the closing cap, and place the bottle preferably between blankets not for having direct contact with the skin and also in order to avoid the possibility of crushing of the element by the body.

Conclusion

This study verifies an important decrease of the burns caused by the tearing of a hot water bottle in children between 2005 and 2014 and significant changes in the epidemiological characteristics. The requirement of certification of resistance of traded goods would be a factor with a direct influence on this achievement. The detection and registration of burn mechanism allow to sustain and design prevention strategies that especially seek to provide greater safety in the environment.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors state that the information has been obtained anonymously from previous data, therefore, Research Ethics Committee, in its discretion, has exempted from obtaining an informed consent, which is recorded in the respective form

Financial Disclosure

Authors state that no economic support has been associated with the present study.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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