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Too hot to handle? Hot water bottle injuries in Sydney, Australia

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ARTICLE INFO

Article history:
Accepted 27 October 2014

Keywords:
Hot water bottle rupture
Scalds
Contact burns
Alleviation of local pain

ABSTRACT

Objective: Hot water bottles are frequently used in the community as a source of warmth, and to alleviate a number of medical symptoms. In Australia it is believed that over 500,000 water bottles are sold annually (Whittam et al., 2010). This simple treatment is known to result in significant burns and has led to mandatory labeling requirements on hot water bottles in Australia. Despite this, few published studies have documented the incidence and nature of burns sustained through their use. This study aimed to assess the incidence, causation and outcome of hot water bottle burns presenting to a major burn trauma unit in Sydney (Australia).

Methods: The New South Wales Agency for Clinical Innovation Statewide Burn Injury database and admission data to the Concord Hospital Burns Injury Unit (major treatment unit) provided information on hot water bottle burns occurring between 2005 and 2013. Demographic details, cause of burn, burn depth, total burn surface area (%TBSA), and outcome of burn were ascertained. In order to assess the burn potential of hot water bottles, a separate study examined the thermic properties of hot water bottles in 'real life' scenarios.

Findings: There were 155 hot water bottle burn presentations resulting in 41 admissions and 24 grafts. The majority of patients were female, and most burns resulted from appliance rupture when used for local pain relief. Patients had an average TBSA of 2.4%. Burns patients were slightly more likely to reside in areas with greater socio-economic disadvantage. In real life scenarios, hot water bottles were shown to retain heat over 50 °C for at least 3 hours (h).

Conclusions: Hot water bottles are a source of common and preventable burns in the community, with women being more at risk than men. Hot water bottles may retain harmful levels of heat over an extended period of time. Additional labeling requirements pertaining to the longevity of hot water bottles and their use among people especially at risk of burns (i.e. children, the elderly, patients who have undergone recent surgery and/or those with conditions associated with sensory impairment) may further reduce the incidence and severity of hot water bottle burns in the community.

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http://dx.doi.org/10.1016/j.burns.2014.10.025
0305-4179/

1. Introduction

Hot water bottles are widely used in the community, with their popularity increasing during the cooler months when they are often used as a topical heat source. In Australia it is believed that well over 500,000 bottles are sold annually [1]. Local application of heat is often touted as a useful adjunct to oral analgesics [2–5], and hot water bottles are often used as a heat delivery mechanism. Hot water bottles are known to be a source of moderate-to-severe burns, however there is little published research to support this assertion.

Much of what is known about hot water bottle injuries pertains to specific patient sub-populations. Studies have reported burns resulting from the misuse of hot water bottles for warming patients following anesthesia [8] and their application to the feet of patients with diabetic neuropathy [9,10]. In addition to areas of peripheral neuropathy, insensate areas of reconstruction have also been shown to be at risk, such as the skin paddles on free flaps [11–16]. Rates of hot water bottle use are highest among the elderly and children; these groups are especially predisposed to more severe burns, due to their thinner and more fragile skins [17].

Despite a lack of research on the incidence, causation and outcomes of hot water bottle burns, their potential as a source of serious burns to the public is acknowledged in Australia by manufacturing standards that aim to reduce the incidence of such burns. Consumer protection safety standards govern the manufacture and supply of hot water bottles [18]. These standards were largely formulated from the British Standard BS 1970:2006 – *Hot water bottles manufactured from rubber and PVC* (Regulations, Explanatory Statement) and were developed after a high-profile Coronial case in which an 82 year old nursing home resident died as a result of severe scalds sustained from a burst hot water bottle [29]. These regulations and standards are currently under review.

The regulations stipulate manufacturing standards of the appliances, such as the thickness of the walls of the vessel, the diameter of the opening at the neck of the bottle and the size of the funnel and stoppers on the vessel. The regulations also set performance standards for hot water bottles, such as a minimum pressure that the vessel must be able to withstand and the strength of the seam. These regulations also require that hot water bottles are marked with a number of warning labels, including warnings not to use boiling water, avoiding fully filling the vessel, labeling the composition of the construction material and the following statement: ''WARNING — HOT WATER BOTTLES CAN CAUSE BURNS. AVOID PROLONGED DIRECT CONTACT WITH THE SKIN''. The warning not to use boiling water must be permanently marked on the bottle and displayed prominently.

Despite their widespread use and potential burn hazard, much of the work in relation to hot water bottle burns in Australia has been approached from a manufacturing angle, and not a public health perspective. Little is known about the public health significance of burns attributed to hot water bottle use in Australia. More specifically, the incidence of such burns is unknown, and we know little about who is most likely to be affected, factors contributing to the burns and patient outcomes. Few experimental studies have examined the thermic properties of hot water bottles in relation to their heat retention, and consequent burn potential. By addressing these aims and examining the thermic properties of hot water bottles, the current study will use a public health approach to shed some light on whether the existing manufacturing standards in relation to hot water bottles in Australia are adequate.

2. Methods

2.1. Burn data

The Concord Hospital Burns Unit admission data and the New South Wales Agency for Clinical Innovation Statewide Burn Injury databases were reviewed for all cases of hot water bottle burns between July 2005 and June 2013. Admission to one of the specialized statewide burns injury units is based on criteria established by the Australian and New Zealand Burns Association, and the International Society for Burn Injuries, and indicated that burn cases admitted to such units require specialized assessment and diagnosis – beyond the scope of a general medical or surgical ward [31]. This includes all cases of partial thickness burns in adults with >10% TBSA, full thickness burns in adults with >5% TBSA, partial/full thickness burns in children with >5% TBSA, burns to the face, hands, feet, genitalia, perineum and across major joints, chemical burns, electrical burns including lightning strikes, burns with concomitant trauma, burns with associated inhalation injuries, circumferential burns of the limbs or chest, burns in patients with pre-existing medical disorders that could adversely affect patient care and outcomes, suspected non-accidental injury including children, assault or self-inflicted, pregnancy with cutaneous burns, burns at the extremes of age – infants and frail elderly, and patients with major skin loss (disorder, disease, injury) would also be considered for admission to the burn unit for appropriate management.

The following information was elicited for each case: age, gender, burn type (scald or contact injury), seasonality, burn depth, size of injury (TBSA %), and requirement for grafting.

The relative risks of severe burn were calculated for each postcode area within the greater Sydney area. The study included all postcodes with a centroid within the Greater Capital City Statistical Area (GCCSA). The GCSSA is defined by the Australian Bureau of Statistics and represents the functional extent of Sydney City [19]. The binary outcome variable was experiencing or not experiencing a hot water bottle burn. The relative risk of hot water bottle burns across the Sydney area was shown in a simple chloropleth map using ArcGIS 10.1. Socioeconomic position of each region was assessed using the Australian Bureau of Statistics (ABS) Socio-economic Indexes for Areas (SEIFA) data [19]. A chloropleth map was generated for Index of Relative Socio-economic Disadvantage with the score distribution divided into deciles in which the lowest decile represents greater disadvantage (determined by variables such as proportion of households with low income, proportion of people unemployed or no qualifications). A Pearson's chi-square test of independence was performed to examine the relationship between relative