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Chemical burns in children: Aetiology and prevention

Rachel D'Cruz [a,c], Tony C.Y. Pang [b], John G. Harvey [a,b,c], Andrew J.A. Holland [a,b,c,*]

[a] The Children's Hospital Burns Research Institute, Burns Unit, and New South Wales Statewide Burn Injury Service, The Children's Hospital at Westmead, Westmead, NSW, Australia
[b] Sydney Medical School, The University of Sydney, Sydney, NSW, Australia
[c] Douglas Cohen Department of Paediatric Surgery, The Children's Hospital at Westmead, Sydney, NSW, Australia

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ABSTRACT

Background: Chemical burns account for a small proportion of total burns in children, but may require specific first aid and different modes of prevention.
Methods: A retrospective study between 2006 and 2012 of children ≤16 years treated with chemical burns at a specialist paediatric burn centre. Data were extracted from a prospectively maintained database.
Results: 56 episodes of chemical burns occurred during the study period. The majority (54%) occurred in boys. There were 39 (72%) patients <10 years and 17 (39%) ≥10 years. Median total body surface area burnt was 1% with nine (16%) patients requiring skin grafting. Only 24 (45%) had adequate first aid. The majority ($n = 46$, 82%) of chemical burns occurred in the domestic setting, especially in the <10 years age group ($P = 0.052$). Non-intentional exposure of chemicals by an unattended child accounted for half of all ($n = 22$, 49%) chemical burns <10 years of age. Eight (47%) burns in patients ≥10 years resulted from self-harm. The most common aetiological agents were household cleaners and aerosols in the younger and older age groups respectively.
Conclusion: Chemical burns remain infrequent but potentially preventable. These burns mainly occur in the domestic setting due to non-intentional exposure of household chemicals in children <10, and due to deliberate self-harm in children ≥10. The use of child-resistant packaging, similar to that used for medications, and improved parental practices could help decrease the incidence of burns in children <10.

1. Introduction

Historically chemical burns mainly occurred in the industrial setting, but in more recent years there has been an increase in the number of domestic burns [1]. Hardwicke et al., in a large study of chemical burns from the United Kingdom, found that industrial burns have decreased by 50% from 1980 to 2000, yet domestic chemical burns have increased by over three times [2]. Ricketts and Kimble similarly reported that the majority of chemical burns (51%) occurred in the domestic setting [3].

* *Corresponding author at*: Douglas Cohen Department of Paediatric Surgery, The Children's Hospital at Westmead, Locked Bag 4001, Westmead New South Wales 2145, Australia. Tel.: +61 2 9845 1908; fax: +61 2 9845 3389.
E-mail address: andrew.holland@health.nsw.gov.au (Andrew J.A. Holland).
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Table 1 – Summary of patient characteristics of study cohort.

	Median (IQR) or *n* (%)			
	All patients	<10 years	≥10 years	*P*-value
Total *n*	56	39	17	
Age (years)	2	2 (1–2)	15 (14–15)	–
Gender Boys	30 (54)	22 (56)	8 (47)	0.57
Girls	26 (46)	17 (44)	9 (53)	
Adequate first aid* [*n* (%)]	24 (45)	19 (51)	5 (31)	0.24
Total body surface area (%)	1 (0.8–1.5)	1 (0.7–2)	1 (0.8–1)	0.48
Full thickness burns? [*n* (%)]	13 (23)	8 (21)	5 (29)	0.50
Patients requiring skin graft [*n* (%)]	9 (16)	6 (15)	3 (18)	1.0
Inpatient treatment? [*n* (%)]	14 (25)	10 (26)	4 (24)	1.0
Length of stay (days)	1 (1–6)	1.5 (1–7)	1 (1–2)	0.36

* Adequate first aid defined as 20 min of cold running water within 3 h of injury.

This shift in the pattern of chemical burns has important implications for their prevention. This would seem particularly important in children when the vast majority of chemical burns occur in the domestic setting [4]. Chemical burns in children have generally been infrequently studied, with only one case series and several case reports published specifically on this subject [4–8]. Further study of the pattern of chemical burn injury in children remains important, as this has implications for prevention and treatment. The aim of this study was to examine the aetiological patterns of cutaneous chemical burns in children presenting to a major burns centre and to identify recommendations to prevent them.

2. Materials and methods

We performed a retrospective study from January 2006 to March 2012 of children treated at The Children's Hospital at Westmead (CHW) with chemical burns. The study cohort comprised of children at or under the age of 16 years and included both patients treated as an inpatient or in an ambulatory care setting. CHW represents the sole paediatric burn centre in the state of New South Wales and the Australian Capital Territory, serving a combined population of approximately 8 million.

Data were collected prospectively into the New South Wales State-wide Burn Injury Service database. The information extracted included age, gender, causative agent, location of injury, adequacy of first aid (defined as cool running water for 20 min within the first 3 h of the injury), percentage total body surface area (%TBSA) affected, mode of treatment (surgical or non-surgical) and length of stay (LOS) in hospital. This study, including the use of information from this database, was reviewed and approved by the institutional Human Research Ethics Committee.

All statistical analysis and charting were performed with Stata SE, version 11.2, for Windows (Statacorp, Texas, USA). Descriptive statistics were reported as median (interquartile range) and numbers (%) as most data were categorical and non-parametric in nature. Inferential statistics employed chi-squared or Fisher's exact tests for categorical data and Kruskal–Wallis rank test for nonparametric continuous variables. A *P*-value of 0.05 was considered statistically significant.

3. Results

During the study period, 69 children were treated for 72 episodes of chemical burns. Sixteen (12%) occurred in hospital secondary to extravasation injuries. As the aetiology and pathophysiology of these injures was different, these were excluded from subsequent analysis. The remaining 56 (78%) chemical burns which occurred in the community formed the cohort for this study.

The majority of patients were boys 30 (54%, Table 1). The median patient age was 2 years, however a bimodal distribution was evident with peaks at 2 and 15 years of age (Fig. 1). This suggested that there were two distinct groups of patients and further analysis was conducted to investigate differences between the younger and older age groups.

Twenty-four (45%) of children received adequate first aid (defined as 20 min of cold running water within 3 h of the burn injury). The median %TBSA burnt was 1%, with 91% of patients having ≤2% TBSA burnt. Overall, 57% (*n* = 32) predominantly involved the limbs, 34% (*n* = 19) the torso and 9% (*n* = 5) the head and neck region. There was one child who had a 46% TBSA burn resulting from falling into a bucket of bleach used for cleaning. Nine of the 56 (16%) burns required skin grafting, with a median graft area of 1% (range 1–40%). There was no

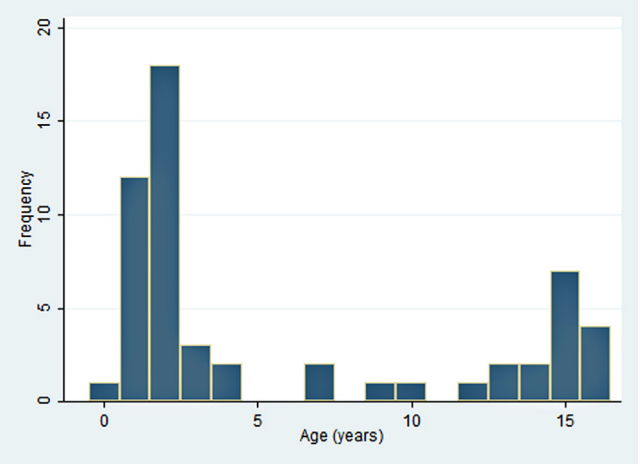

Fig. 1 – Histogram of age distribution of study cohort.