



Research article

Children with burns referred for child abuse evaluation: Burn characteristics and co-existent injuries



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ABSTRACT

Intentional burns represent a serious form of physical abuse that must be identified to protect children from further harm. This study is a retrospectively planned secondary analysis of the Examining Siblings To Recognize Abuse (ExSTRA) network data. Our objective was to describe the characteristics of burns injuries in children referred to Child Abuse Pediatricians (CAPs) in relation to the perceived likelihood of abuse. We furthermore compare the extent of diagnostic investigations undertaken in children referred to CAPs for burn injuries with those referred for other reasons. Within this dataset, 7% (215/2890) of children had burns. Children with burns were older than children with other injuries (median age 20 months vs. 10 months). Physical abuse was perceived as likely in 40.9% (88) and unlikely in 59.1% (127). Scalds accounted for 52.6% (113) and contact burns for 27.6% (60). Several characteristics of the history and burn injury were associated with a significantly higher perceived likelihood of abuse, including children with reported inflicted injury, absent or inadequate explanation, hot water as agent, immersion scald, a bilateral/symmetric burn pattern, total body surface area $\geq 10\%$, full thickness burns, and co-existent injuries. The rates of diagnostic testing were significantly lower in children with burns than other injuries, yet the yield of skeletal survey and hepatic transaminases testing were comparable between the two groups. This would imply that children referred to CAPs for burns warrant the same level of comprehensive investigations as those referred for other reasons.

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1. Introduction

Approximately 70 percent of children who attend hospital with burns or scalds are less than five years of age (American Burn Association, 2014; Kemp, Jones, Lawson, & Maguire, 2014). They sustain unintentional burns when exploring their environment without the cognitive awareness or motor skills to avoid hot household items and liquids and require constant supervision in a safe environment to prevent such incidents (Kemp, Jones, et al., 2014; Shields, McDonald, Pfisterer, & Gielen, 2015; Zou et al., 2015). A proportion of children who have sustained a burn have been physically abused or neglected and

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an estimated 3–24% are referred to child protection services for suspected abuse (Chester, Jose, Aldlyami, King, & Moiemmen, 2006; James-Ellison et al., 2009; Kemp, Maguire, Lumb, Harris, & Mann, 2014b; Wibbenmeyer et al., 2014). In addition, children younger than three years of age who sustain a burn from any cause are seven times more likely to suffer from future child abuse or neglect by the age of six years than a case matched control population (Hutchings, Barnes, Maddocks, Lyons, & James-Ellison, 2010; James-Ellison et al., 2009). Burns are therefore both sentinel and significant injuries of maltreatment.

There are few published studies that describe the characteristics of burns amongst children who have been referred to a child protection team especially those who sustain non-scald burns (Kemp, Maguire, et al., 2014; Maguire, Moynihan, Mann, Potokar, & Kemp, 2008).

Although a skeletal survey is indicated for all children under the age of two years with any suspicious injury including bruises and other skin marks in non-ambulatory infants (American College of Radiology (ACR) & Society for Pediatric Radiology (SPR), 2014; Christian & Committee On Child Abuse and Neglect, 2015), studies have shown that rates of skeletal survey completion are relatively low in children with burns (DeGraw, Hicks, Lindberg, & Using Liver Transaminases to Recognize Abuse Study Investigators, 2010), despite a significant prevalence of associated occult fractures (Fagen, Shalaby-Rana, & Jackson, 2014; Hicks & Stolfi, 2007).

This study aims to characterize burns and scalds in children referred to CAPs, determine the likelihood of abuse, the level of associated injuries and which variables are associated with likely abuse together with the rate and yield of diagnostic testing for associated injuries.

2. Methods

2.1. Study design

This is a retrospective secondary analysis of data collected within the ExSTRA research network, methods of which have been published previously (Lindberg et al., 2012). The ExSTRA research network was a prospective, observational, cross-sectional study of children less than 10 years of age referred to 20 US child protection teams for concerns for possible physical abuse between 15 Jan 2010 and 30 Apr 2011. Teams were selected because they chose to participate and endorsed a common screening protocol for the assessment of siblings and contact children. In each center the child protection teams (CPTs) were led by Child Abuse Pediatricians (CAPs). Each child abuse team obtained approval from their respective institutional review board to participate in the parent study with waiver of informed consent. This study of previously collected data stripped of all patient identifiers was determined not to constitute human participants research by the Colorado Multi-Institutional Review Board. CAPs documented the teams' ultimate perceived likelihood of physical abuse using a previously published 7-point scale of the level of concern for abuse (Lindberg, Lindsell, & Shapiro, 2008). Level of concern for abuse was dichotomized as in prior studies (Lindberg et al., 2012). For this analysis we considered levels 5–7 to represent a high likelihood of abuse, and levels 1–4 to represent a low likelihood of abuse to determine the burn characteristics associated with high vs. low concern for abuse. Our sample size did not permit analysis as an ordinal variable since ultimate likelihood of abuse ratings tend to cluster at the poles – e.g. there are relatively few children ultimately rated as indeterminate likelihood of abuse.

2.2. Data abstraction

During the parent study, data were entered prospectively into a secure, web-based data entry form (Quickbase; Intuit, Waltham, Massachusetts). The data collected included demographic features and findings from clinical evaluation and laboratory tests. Investigators were asked to describe the history and the characteristics of injuries in free-text fields. A single researcher (MCP) abstracted relevant data from data fields and the free-text information to determine several characteristics of the burn injury, the history of injury, and the clinical evaluation.

Factors analyzed include the burn type (e.g. scald, contact burn), causative agent (e.g. hot water, iron), recorded mechanism (e.g. spill, touch, immersion), pattern (e.g. circumferential, symmetric), size (i.e. total body surface area [TBSA] affected), depth, and anatomical location. Characteristics of the history included whether there was any reported witnessed or admitted inflicted injury or preceding events (e.g.: child had soiled itself prior to injury, a sibling blamed for the burn, previous burn injury, history of assault, history of fall, sexual abuse), additional injuries, and whether the burn was the primary presenting complaint or identified during clinical evaluation. For characteristics abstracted from free-text fields a second researcher (DN) independently coded a random sample of 10% of the cases, and agreement was measured using Cohen's kappa test.

2.3. Statistical analysis

Descriptive statistics were used to describe prevalence of demographic features as well as history and burn injury characteristics. The distribution of age within the group of children who sustained a burn was compared with the remaining children in the ExSTRA database using Mood's median test. For categorical frequency data, comparisons between groups were made using contingency tables and Chi-squared testing. Associations are expressed by odds ratios with 95% confidence intervals and *p*-values. Values of *p* < .05 were considered statistically significant. Statistical analyses were performed with IBM SPSS Statistics v20 and the online tool Vassar Stats (vassarstats.net).

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