BRIEF REPORTS

Curling Iron-related Injuries Presenting to U.S. Emergency Departments

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Abstract. **Objective:** To describe curling iron-related injuries reported to the National Electronic Injury Surveillance System (NEISS) between January 1, 1992, and December 31, 1996. **Methods:** The authors retrospectively reviewed data from NEISS, a weighted probability sample of emergency departments (EDs) developed to monitor consumer product-related injuries. The information reported includes patient demographics, injury diagnosis, body part injured, incident locale, patient disposition, and a brief narrative description. The authors reviewed the narrative in the hair care products category and abstracted records indicating the injury was caused by contact with a curling iron. Also analyzed were the design features of commonly available curling irons purchased from national discount department stores. **Results:** There were an estimated 105,081 hair care product-related injuries in the five-year period, of which 82,151 (78%) involved a curling iron. Seventy percent of injuries were to females. The patient's median age was 8 years (range 1 month to 96 years). The most commonly occurring injury was thermal burns (97%; 79,912/82,151). Ninety-eight percent of the injuries occurred in the home and 99% of the patients were discharged home from the ED. In patients <4 years old, 56% of burns occurred by grabbing or touching, while in those ≥10 years the burns occurred by contact while in use. In the older group 69% of burns were of the cornea. Most curling irons use small amounts of power, yet there are no standards for temperature settings or control. The cylinder containing the heating element is mostly exposed, and many irons do not have a power switch. **Conclusions:** The most common injury resulting from curling irons is thermal burns. The mechanisms and patterns of injury in developmentally distinct age groups suggest that many of these injuries could be prevented by public education and the re-engineering of curling irons. **Key words:** consumer product safety; burns; wounds and injuries; eye burns; accident/injury prevention. ACADEMIC EMERGENCY MEDICINE 2001; 8: 395–397

Hair care products, including electric curling irons, are the third leading cause of consumer product-related ocular trauma in the United States.[1] To the best of our knowledge, there have been no comprehensive studies of this, but several case series in the 1980s cited electric curling irons as a cause of eye injury.[2–5] Curling irons are also responsible for an appreciable number of contact burns. Banco and colleagues report that contact burns were the most common burns treated in one urban emergency department (ED).[6] More than 10% of the contact burns were related to curling irons. They conclude that the causes of burns differ for different patient populations and burn prevention strategies should be specific to the type of injury and patient group. Implementation of these preventive strategies requires information that is not yet available.

The purpose of this study is to describe the spectrum and mechanisms of curling iron-related injuries presenting to a representative sample of EDs in the United States. In addition, we describe design features of commonly available curling irons. We also make several recommendations regarding methods to reduce such injuries.

METHODS

Study Design. We retrospectively analyzed information in the U.S. Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) database for patients treated between January 1, 1992, and December 31, 1996. We also inspected design features of commonly available curling irons. The institutional review board (IRB) exempted the study from informed consent.

Study Population. During the study period, NEISS comprised a stratified probability sample of 91 hospital EDs selected from all hospitals with EDs in the United States and its territories.[7] Stratification is by ED annual census and geographic region. Each ED is assigned a statistical weight to represent others in the same ED census stratum. The statistical weight represents the inverse of the probability of selection of EDs in each census stratum. Each injury case from a participating ED represents the same number of injuries as the statistical weight of the ED. Weighted data are summed to generate national estimates.[8] The NEISS-generalized relative sampling errors for the study years

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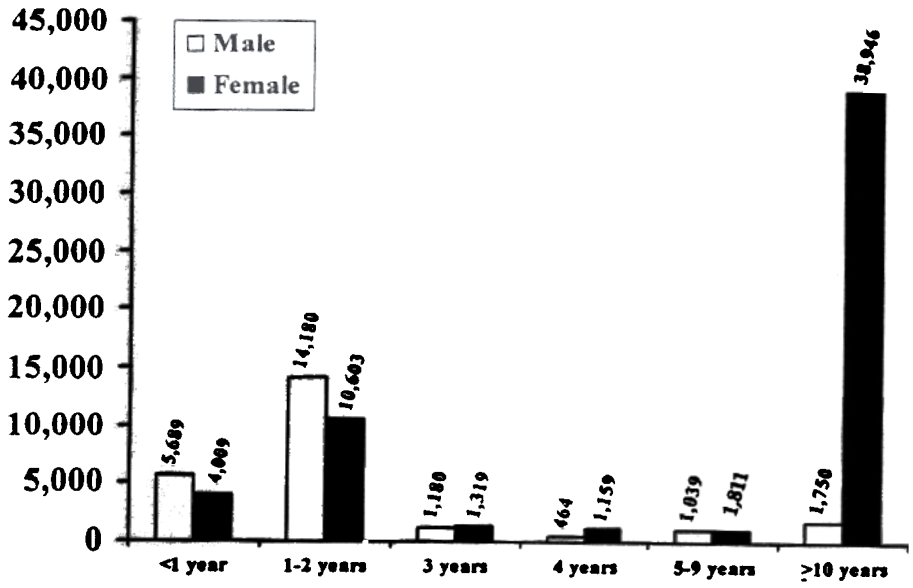

Figure 1. Gender distribution in each age group with curling iron-related injuries (n = 82,151).

ranged from 6% for estimates of 1.5 million injuries to 26% for estimates of 1,200 injuries. The generalized standard error for an estimate of 25,000 injuries for four of the five study years was 11%, or 2,750 injuries; for the fifth year the generalized standard error for an estimate of 25,000 was 10%.[9]

Measurements. The NEISS database collects information on the date of treatment, age, gender, diagnosis, body part injured, patient disposition from the ED, consumer product(s) involved, incident locale, and a brief free-text description for each unintentional injury treated in the ED. This information is entered in computers in the EDs and uploaded each night into the Consumer Product Safety Commission computer database. Curling iron injuries are not coded separately but are reported as part of the "Hair Care Products" category.

A research assistant reviewed the free-text field of the Hair Care Products category and extracted all cases where an electric curling iron was identified as the consumer product involved. Cases were categorized as a thermal burn or a soft-tissue injury. The thermal burns were defined as the burns caused by hot curling irons, whereas minor abrasions, cuts, and punctures represented soft-tissue injuries. The mechanism of injury was classified into one of five categories: grabbed the barrel of the iron, pulled on the cord, unintentional contact while in use, other, or unknown. For analysis, patients were divided, by age, into categories that approximate developmental stages: <1, 1–2, 3, 4, 5–9, and ≥10 years. In order to study design features of commonly available curling irons, representative products were purchased and inspected by an electrical engineer (NI) for their design features. The outer structures (i.e., the clamp and barrel) and the position and heating effects of the heating element of the curling iron were examined. The maximum attainable temperature for the curling irons was also determined. In addition, published specifications for manufacturing curling irons were reviewed. The power consumption information came from review of manufacturer's data.

Data Analysis. SUDAAN (Research Triangle Institute, Research Triangle Park, NC), a statistical package for weighted samples, was used to calculate descriptive statistics. No statistical tests were conducted in this descriptive study with a large number of observations.

RESULTS

There were an estimated 105,081 hair care product-related injuries reported in the five years of observation. Of these, 82,151 (78%) were related to curling irons. Almost all (97.3%; 79,112/82,151) of the injuries were thermal burns. Soft-tissue injuries accounted for 1% (n = 917/82,151) of the cases. Ninety-eight percent (58,515/59,800) of the incidents in which a locale was recorded occurred in the home. Approximately 99% of the patients were treated and released from the EDs. The remainder either were transferred to another facility or were admitted.

More than two thirds (57,848/82,151) of the patients were female. The median age of the injured patients was 8 years (range 1 month to 96 years of age). The age and gender distributions of the injured patients are shown in Figure 1. Gender does not appear to be a factor in the younger age groups, while older patients are more likely to be female. Table 1 presents more details about age and the mechanism of curling iron-related burns. Younger children (≤4 years) were most likely to sustain injury by grabbing the barrel of a curling iron (56%; 21,467/38,141), although a substantial number (30%; 11,390/38,142) received injury through unintentional contact while in use or pulling on the electrical cord (14%; 5,285/38,142). Older children were most likely to sustain injury while using a curling iron (89%; 34,733/39,067).

The injured body parts for different age groups were consistent with the mechanisms of injury observed. Patients in the youngest age group (≤4 years) were burned predominantly on the hands and fingers (58%; 22,244/38,142). Patients more than 9 years old most often suffered ocular thermal burns (65%; 25,440/39,067) or face/neck thermal burns (12.7%; 4,945/39,067).

DISCUSSION

Thermal burns are the most frequent injury caused by curling irons. The mechanisms of injury correlate well with the injured patients' age and the anatomic location of the resulting injury. Most thermal burns in young children are to the hands and fingers and are the result of grabbing the barrel of the curling iron. Older patients were more likely to experience ocular burns

TABLE 1. Mechanisms of Curling Iron-related Thermal Burns in Developmentally Distinct Age Groups (n = 79,112)

Age Group	Grabbed a Curling Iron	Pulled on Curling Iron Cord	Unintentional Contact with Curling Iron	Unknown	Other
<4 years (n = 38,142)	21,467 (56.2%)	5,285 (13.8%)	11,390 (29.9%)	— —	— —
≥10 years (n = 39,067)	2,903 (7.4%)	34 (0.1%)	34,733 (89%)	1,076 (2.75%)	321 (0.8%)

while using the device in the way it was marketed. Many of these burns appear to be preventable through modification of curling iron design and patient education.

The mechanical inspection of curling irons found that curling irons are simple and inexpensive instruments that are widely available for routine home use. They use a small amount of power. All use below 100 watts, with most using under 20 watts. The clamp and cylinder of the irons are fully exposed. The heating element consists of a bent wire that sits inside the cylinder with rather non-uniform heating effects. It seems to rely on the heat conductivity of the cylinder itself to distribute the heat. There are no standards for a maximum temperature and no requirement for installation of thermostats. The maximum attainable temperature on the inspected curling irons ranged from 205°F to out of range for a thermometer that could measure temperatures up to 230°F. Some curling irons cannot be switched off except by unplugging the instrument.

Modifications of curling iron design that would help prevent injuries might include lower operating temperature, shielded tips on cylinders and clamps, and coating of the outer aspect of the barrel and clamp with a porous material that does not conduct heat as well and would therefore reduce burning if touched unintentionally. In addition, installation of a trigger switch combined with quick heating and a mechanism to wind up the cord of curling irons into a space within the handle of curling irons might also be helpful in reducing injuries.

Educational efforts aimed at reducing the number of unintentional injuries might include warning labels on curling iron packages with respect to the possibility of sustaining burns, inclusion of information on curling iron-related burns in the anticipatory guidance during the well-child visit, and posting of this information on injury prevention-related web sites.

LIMITATIONS AND FUTURE QUESTIONS

This study, based on analysis of a national database, has several limitations. First, the database captured only information about injuries in patients who sought medical attention in a participating ED. Second, we were unable to calculate an incidence rate because there is no available information on how many children and adults are exposed to curling irons at any time. Third, NEISS does not record intent of injury. As such, the data set may include cases related to abuse or intentional injury. Fourth, NEISS does not provide information on the depth or consequences of thermal burns. Thus, it is unclear how severe these burns were.

Special studies using NEISS with support of the Consumer Product Safety Commission may be helpful to obtain information on curling iron-related injuries that is not yet available.

CONCLUSIONS

The most common injury caused by curling irons is thermal burns. The distinct mechanisms producing thermal burns related to the use or access to curling irons in different age groups suggest different strategies are needed for prevention. These include public education and modification of curling iron design to produce a safer appliance. Parents should be made aware of the possibility of curling iron injuries. Older children (and adults) should also be educated. Both groups would benefit from safer curling irons.

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