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Effect of a screening profile on the diagnosis of nonaccidental burns in children

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Study objective: To determine if awareness of factors associated with burn abuse increases recognition and reporting by emergency physicians.

Design: The study consisted of a retrospective chart review and a subsequent intervention.

Setting: An urban pediatric emergency department (ED).

Participants: All patients with the diagnosis of burn seen in the ED.

Intervention: The retrospective chart review (October 1, 1990, to September 30, 1991) determined the number of patients seen in the ED, diagnosed with burns, and reported to the department of social service. We then determined whether or not the department of social service, after completion of their investigation, "verified" that abuse had occurred. In addition, other services provided to the family by the department of social services were determined. The prospective study (April 1, 1992, to March 30, 1993) introduced a checklist of 13 factors associated with abusive burns into the history and physical examination of all burn victims presenting to the ED. Changes in overall referrals to the department of social service as well as in the numbers of cases in which abuse were verified or services offered were then determined.

Results: Prior to any intervention, 3% (3/87) of burns presenting to the ED from 1990 to 1991 were reported to the department of social service. This contrasted with 12.1% (26/215) of burns presenting after introduction of the checklist. Burn victims, 1/87 (1%), in the retrospective study and 16/215 (7.4%) burn victims in the prospective study received social service intervention after a report was initiated by the ED staff ($P < .002$). Burn injuries 1/87 (1%) and 7/215 (3.3%), reported during the two studies were substantiated as abusive by social services.

Conclusion: We conclude that the use of the checklist increased effective social service referral for burn abuse.

INTRODUCTION

Burns are the fourth leading cause of fatal injury in the United States.¹ Twenty-five percent of burn victims are children. The proportion of child burn victims who have been physically abused

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varies widely in reported studies from 4 to 39%.²⁻⁷ This variability may reside in the populations studied as well as in the differing abilities of physicians to recognize abuse as a cause of the burns. Intentionally inflicted burns are more likely to be fatal.⁷ In addition, when children present with abusive injuries and physicians fail to diagnose abuse, those children are likely to sustain other abusive injuries in the future.⁷⁻⁹

Hight et al.⁸ used epidemiologic studies to develop a 13-factor profile on burn patients to identify cases of abuse. In a related study, Hammond and colleagues⁹ determined the positive predictive value of Hight's criteria for identifying abused or neglected children among patients admitted to a burn center. When any single criterion was present, 40% of the children were determined to have been abused. With any two criteria the number increased to 62%.

We hypothesized that the proportion of burn cases reported by emergency physicians as abuse would increase with awareness of the 13 associated risk factors outlined in Hight's burn profile. In addition, we hypothesized that the percent of reported cases in which abuse was substantiated by social services would also increase. To this end, the Hight profile (Table 1) was appended to the chart of all burn victims seen in the emergency department (ED), thereby reminding physicians of important clues to abuse in the history and physical examination of children presenting with burns.

METHODS

Study design. The study consisted of a retrospective chart review and a prospective intervention. The one-year retrospective chart review from October 1, 1990, to September 30, 1991, was performed to determine the number of patients seen in the ED diagnosed with burns and reported to social services. The following variables were studied: age, sex, percentage of body surface area burned, type and degree of burn, and involvement of social services. For those cases reported to social services, the appropriate county department was contacted to determine the results of their investigation. If the department of social services (DSS) felt abuse had occurred, the case was considered verified.

The one-year prospective study from April 1, 1992, to March 30, 1993, introduced a checklist with 13 factors associated with abusive burns. The checklist was appended to the ED chart in every burn case seen. In addition, the resident and attending physicians were instructed to specifically inquire about these factors. The doctors were not, however, given any information about the correlation between the factors listed and burn abuse. Essentially, physician awareness of factors prevalent in abusive burn cases was increased by asking them to include the checklist in their assessment. Because the use of the 13-item questionnaire was an expansion of the history and physical examination, informed consent was not deemed necessary. The checklist enhanced quality of care.

TABLE 1
Burn profile checklist

History	
1)	Burn attributed to sibling
2)	Unrelated adult seeking medical attention
3)	Differing historical accounts
4)	Treatment delay >24 h
5)	History of prior accidental injuries
6)	Inappropriate affect—parent
7)	Inappropriate affect—child
Physical	
8)	History incompatible with physical examination
9)	Burn incompatible with development age
10)	Mirror image burns
11)	Localized burns of perineum, genitalia, buttocks
12)	Burns older than history given
13)	Other injuries

+1407 Confirmed
+2607 "

TABLE 2

Patient demographics of the retrospective and prospective studies

Patient characteristic	Prospective Analysis (n=215)	Retrospective Analysis (n=87)	P value
Age	3.9 (1 mo–18 yrs)	4.3 (4 mo–16 yr)	0.59
Gender—male:female	1.3:1	1:1.2	0.14
Admissions	5%	9%	0.12
Burn characteristics			
Percent body surface area	2.1 (0.5–27)	2.6 (0.5–20)	0.25
Degree	2 (84%)	2 (83%)	0.43
Type			
Scald	86 (40%)	29 (33%)	
Contact	100 (47%)	41 (46%)	
Other	29 (13%)	17 (17%)	0.33

The same patient variables obtained in the retrospective chart review were obtained in the prospective study. In accordance with state law, all cases of suspected abuse were reported to the DSS. Where abuse was not substantiated by DSS, we asked if services were received by the family to safeguard the child.

Study population. All patients with burns evaluated in the ED at The Children's Hospital of Denver during the study period were enrolled. The service, located in an urban setting, averages 30,000 patient visits per year.

Data analysis. Data were analyzed using Statistix® and SAS®.^{10,11} Referral patterns between the retrospective and prospective studies and differences in DSS intervention were compared using Fisher's exact test.^{10,11}

Fisher's exact test was used to check the ability of the 13 risk factors to identify suspected abuse cases. An *a priori* level of statistical significance was chosen at $P<.05$.

RESULTS

A total of 105 burn patients were seen during the time period covered by the retrospective study. Eighty-seven charts (83%) were available for review. The other 22 charts were unable to be located by the Medical Records department. During the prospective study, 215 burn patients were seen, and 169 checklists (78%) were completed. All 26 cases reported to DSS had checklists completed.

The two study populations were compared on the basis of age, gender, percent of body surface area burned, type of burn, and degree of burn. No significant differences between the two populations were found (Table 2).

From the retrospective chart review, 3/87 (3%) burn patients were suspected of having nonaccidental injuries and were reported to social services. After introduction of the checklist, 26/215 (12.1%) patients were suspected of having nonaccidental burn injuries ($P = 0.018$) and were reported to social services. The increase in families receiving intervention by DSS between the retrospective study, 1/87 (1%) and prospective study, 16/215 (7.4%) was statistically significant. The difference between cases verified as abuse by social services in the retrospective 1/87 (1%) and the prospective 7/215 (3%) groups did not reach statistical significance ($P = 0.276$).

Factors found to be significantly associated with referral for child protective services by Fisher's exact test after introduction of the checklist included: burn attributed to sibling, differing historical accounts, history of prior accidental injuries, inappropriate affect of parent, such as emotional detachment, history incompatible with physical examination, burn incompatible with developmental

age, mirror image burns, and presence of other injuries (Table 3). One of five cases of mirror image burns was not reported. This occurred in a three year old who had first degree burns consistent with jumping rapidly in and out of a tube of hot water.

Several of Hight's criteria occurred only once in the study population. Children with these factors were reported to social services. These factors included: burns localized to the perineum, genitalia, and buttocks, unrelated adult seeking medical attention, and inappropriate affect of child, such as inability to cry or respond to pain. Only one factor, treatment delay >24 hours, occurred more than once and was found not to be significant. No burns were estimated to be older than the history given.

TABLE 3
Risk factors identified by emergency physicians on burn profiles completed during the prospective study

	Number of patients		P value ^a
	Case reported to DSS (n=26)	Case not reported to DSS (n=143)	
Burn attributed to sibling	10 (38%)	9 (6%)	0.00005
Differing historical accounts	4 (15%)	0 (0%)	0.0005
History of prior accidental injuries	3 (11.5%)	2 (1%)	0.026
Burn incompatible with developmental age	4 (15%)	1 (0.7%)	0.002
History incompatible with physical examination	8 (31%)	4 (3%)	0.00004
Inappropriate affect —parent	3 (11.5%)	1 (0.7%)	0.012
Presence of other injuries	2 (8%)	0 (0%)	0.023
Mirror image burns	4 (15%)	1 (0.7%)	0.002
Treatment delay >24 h	5 (19%)	8 (6%)	1.0
Unrelated adult seeking medical attention	0 (0%)	1 (0.7%)	0.85
Inappropriate affect —child	1 (4%)	0 (0%)	0.15
Localized burns of perineum, genitalia, buttocks	1 (4%)	0 (0%)	0.15
Burns older than history	0 (0%)	0 (0%)	1.0

^aP values reflect a comparison of those findings between the population of children reported to DSS versus those not reported to DSS.

DISCUSSION

Many epidemiologic studies exist on child abuse by burning. Contact or scald burns are the most frequent mechanism of both abusive and nonabusive injury.^{1,7,8,12} Generally, abused children are younger than accidentally burned children (2 vs 2.5 years of age). While boys are more likely than girls to be burned accidentally, 1.5:1,^{13,14} studies specific for burn abuse offer conflicting data. Three studies showed no difference between the sexes in incidence of inflicted burns.¹⁻³ Hight showed a male preponderance (61%), and Hammond showed a female preponderance (63%) in incidence of inflicted burns. As these statistics suggest there are few demographic characteristics associated with children having burn injuries that are pathognomonic of abuse. Physicians need adjunctive tools to identify potential cases of abuse. Hight and Hammond used a burn profile as a screening test to identify those children with nonaccidental trauma.

The goal of this study was to determine if an increase in awareness of the factors associated with burn abuse influenced physician behavior. The introduction of Hight's profile into the history and physical examination of burn patients presenting to the ED increased the reporting of suspected abuse from 3 to 12% of cases. Not only did overall DSS referrals for burn abuse increase, but the number of effective referrals to DSS also increased from 1% in the retrospective review to 7% after the intervention in the prospective study. Simply by making the burn profile available to physicians and calling attention to it, reporting practices were improved.

Of the 215 burn profiles in the prospective study, 46 were not completed. As stated, burn profiles were appended to all charts. Hence, profiles were equally available to all physicians, and so should have provided a consistent influence on physician practices. However, conclusions regarding specific factors from the burn profile (Table 3) must be interpreted with caution. Missing values were those from unreported cases; however, factors from the burn profile might have been present. These missing values may have changed the factors found to be significantly associated with referral for child protective services.

Effective referrals were considered either cases substantiated as abuse by social services or those in which families received services from agencies even when abuse was not found. Often there is a strong suspicion the child has been intentionally injured, but the information does not meet the "standards of proof" required by courts of law. For instance, in Colorado, "a preponderance of evidence" is used as the standard of proof in juvenile or civil cases. For cases prosecuted in a criminal court, "beyond a reasonable doubt" is used as the standard of proof. Also, in many cases, social service agencies will not ask the courts to find abuse if the family is willing to accept services such as homemaker's helpers, psychotherapy, and help with housing or home repairs to provide a safer environment for their children. Because of this, we called an effective referral those situations in which families received services. Receipt of services from DSS was considered as having the potential to enhance the safety of the child.

A problem affecting the generalizability of our findings was the small number of abusively burned children. The retrospective review identified only three children and one effective referral. Three of the 13 factors from the checklist occurred only once in the population of the prospective study and so could not be shown to be statistically significant. Further studies with increased subject numbers and more reported cases could influence our conclusions.

A second issue affecting the generalizability was the site of the study, an ED in a children's hospital. Pediatricians are thought to be highly attuned to issues of abuse and so may have been familiar

with some criteria included in the checklist. One could hypothesize a greater influence in effective referrals from physicians predominantly treating adults and potentially less familiar with these criteria. Studies are in progress involving a general suburban ED and an acute care clinic in a family practice setting.

Of the 26 families reported to social services, 16 children were investigated for abuse or neglect, and seven were eventually substantiated as having been abused.¹ A primary assumption in this study is that a social service evaluation is the gold standard for verification of abuse. The sensitivity and specificity of this gold standard will vary from county to county and worker to worker. Only with serendipity is evaluation of this gold standard possible. Long-term follow-up revealing subsequent concerns of abuse or neglect and, rarely, confession by the perpetrator could confirm the conclusions of social services. However, 16 families investigated by DSS received services. Indication of services offered by DSS can be used as an objective measure for effective physician reporting of suspected abuse.

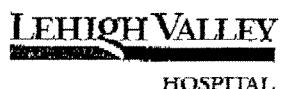
There are many barriers to physician reporting. These include lack of information, lack of training in interviewing, fear of time involvement, fear of litigation, perceived inadequacy of the system, fear of creation of an adversarial role between the physician and family, and concern about inciting conflict within the family.¹⁵ The use of the checklist introduces an objective measure that may break down some of the psychologic barriers against reporting abuse. It is the legal responsibility of the physician to report suspected abuse. This checklist calls attention to suspicious findings and by doing so may increase recognition and reporting of abuse.

The use of the 13-factor checklist increased the number of burn cases reported by emergency physicians as abuse. Effective referrals to DSS, those referrals leading to family interventions, also increased.

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**FACSIMILE TRANSMITTAL COVER SHEET**

DATE: 3/17/98

TO: Dr. Randolph Cordle

ER - CC

FAX #: 7160

FROM: Inge Meyers
Medical Record Department
Lehigh Valley Hospital
Telephone (610) 8344

FAX #: 610-402-8322

Page(s), including cover sheet 2

NOTES: Dr. Cordle,

As per our phone conversation, please complete the attached request
form for your case identification and return to me to Med. Rec. - CC.

Thank you!

Inge

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LEHIGH VALLEY HOSPITAL
RESEARCH PROJECT DATA FORM

Please print the following data:

YOUR NAME Randy Cordele

TITLE

Emergency Dept
Associate Vice Chair
Education/Research

DEPARTMENT Emergency Medicine

PHONE

402 7161

TOPIC AND PURPOSE OF STUDY:

Based on previous study - to see if similar results generalizable to our facility.

Study Effect of a screening profile on the diagnosis of nonaccidental burns in children. First do retrospective cohort then potentially do follow up education and prospective analyses.

INFORMATION DESIRED (Be Specific - If Necessary, Continue on Back of Form)

All pts. under age 16 16 years old or younger with diagnosis of sometype of burn seen in the Emergency Department. This should include admitted and non admitted patients.

PERIOD OF TIME FROM WHICH STATISTICS/CHARTS ARE TO BE PROVIDED LAST 5 years

HECK BOX OF DESIRED POPULATION (S) TO BE INCLUDED:

1/1/92 through 12/31/97

CC & I-78

17th & Chew

BOTH CC & I-78 and 17th & Chew

June 98

DATE RESEARCH PROJECT REVIEW TO BEGIN

?

APPROXIMATE NUMBER OF CHARTS TO BE REVIEWED

-

IS INFORMATION BEING USED FOR PUBLICATION? YES NO

ARE PATIENT NAMES BEING USED; IF YES, WHY? No

THE CHART IS A LEGAL DOCUMENT AND THE PROPERTY OF THE LEHIGH VALLEY HOSPITAL. I WILL HONOR THE CONFIDENTIALITY OF THE CHARTS WHICH I REVIEW.

Randolph Cordele

Signature of Requestor

3/18/98

Date of Request