

Child Abuse by Burning: A Review of the Literature and an Algorithm for Medical Investigations

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Background: Investigations of suspected child abuse must be conducted thoroughly to protect the abused child and to bring the abuser to trial. We have reviewed the literature on child abuse by burning and have synthesized, from the experience of ourselves and others, an algorithm that can be used by physicians, social workers, and nurses involved in the investigation of alleged child abuse by burning.

Methods: A MEDLINE search was conducted for the years 1966 through 2000 for human studies written in the English language using the key terms “child abuse” and “burns.”

Results: Information from these articles was reviewed and included in this article. On the basis of our own experience and that cited in the literature, an algorithm was constructed

to guide hospital-based personnel in their management of child abuse by burning.

Conclusion: Medical investigation of suspected child abuse by burning can be performed systematically using an algorithm, thereby minimizing the chance of either false-positive or false-negative reporting.

Key Words: Burns, Child abuse.

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Each year, approximately 1.5 million American children are abused or neglected.^{1,2} Child abuse by burning makes up approximately 6% to 20% of all child abuse cases.³ As is true in many cases of child abuse, an accurate diagnosis of abuse by burning is difficult to establish.⁴ The sensitivity of our techniques for diagnosing child abuse by burning is proportional to the number of true-positives, that is, abused children reported to Child Protective Services (CPS). On the other hand, the specificity of our diagnostic techniques is proportional to the number of true-negatives, who are accidentally injured children who are correctly identified as not abused.

There are two categories of inaccurate diagnosis. False-positives occur when the physician suspects abuse, but the child was injured accidentally. (In some cases these may be children reported to CPS, but CPS is unable to substantiate abuse.) False-negatives, on the other hand, are abused children who are not reported to CPS. Of the two diagnostic errors, the latter is potentially the more dangerous to the child, although the former can be emotionally damaging to the family.

Parents innocent of the charge of child abuse experience emotional turmoil during the investigation. The investigation may uncover dysfunctional family behaviors and become a source of stress itself. Even well-adjusted families with ma-

ture coping skills experience distress during the investigation. At the very least, the investigation should be carried out with compassion, respect, and tolerance, keeping in mind that it is the responsibility of CPS, the police, and the courts to make the final decision of guilt or innocence.

The price of inaccurate diagnosis or improper management of child abuse is high, however, with up to 50% of children suffering recurrent abuse when returned to the abusive home, abuse that is often associated with severe injury or death.^{2,5} Inaccurate diagnosis of child abuse can be avoided by proper management of a medical investigation into the allegation of child abuse. We have reviewed the literature on child abuse by burning and have synthesized from the experience of others and ourselves an algorithm that we now use routinely. This algorithm can be used to direct the activities of physicians, social workers, and nurses involved in the investigation of alleged child abuse by burning.

PATIENTS AND METHODS

We used the following definitions in our evaluation of children admitted to the Jaycee Burn Center.^{5,6} Abuse is the willful and deliberate act by a caregiver resulting in physical injury of the child; neglect is the omission by the caregiver to take minimal precautions for the proper supervision of the child's health, thus failing to protect the child from injury; and accident is the lapse in the usual protection provided to the child by circumstances beyond the reasonable control of the caregiver. An electronic search of the medical literature was performed of human studies in the English language using MEDLINE from 1966 through 2000 using the terms “child abuse” and “burns.”

RESULTS

A total of 134 articles were identified and reviewed for inclusion in this article, providing the support of expert opin-

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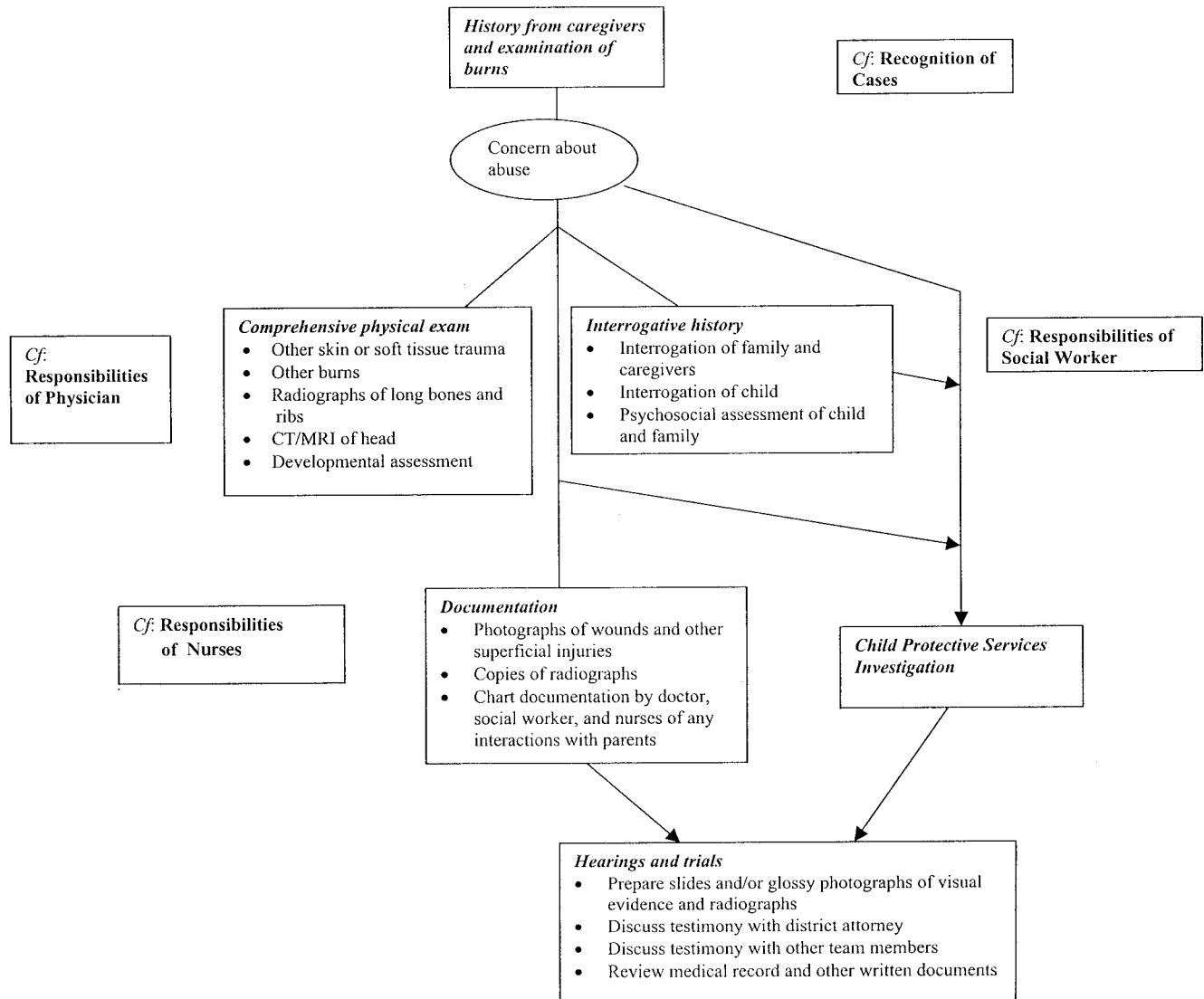


Fig. 1. Algorithm for medical investigations.

ion in the field of child abuse for our clinical recommendations. In addition, we drew on our personal experience at the North Carolina Jaycee Burn Center from 1996 through 2000. During that period, 581 children under the age of 19 were admitted. Of these, 27 (4.7%) were discharged with the diagnosis of child abuse (*International Classification of Diseases, Ninth Revision* code 995.5 or E967). A retrospective review of the 3-year period from 1992 through 1994 identified a cohort of 21 abused children of 238 pediatric admissions (9%). In these 21 cases of child abuse, 15 (71%) of the perpetrators were charged with a felony, and 9 (43%) were convicted.⁷

On the basis of the review and our experience, we developed an algorithm that describes a systematic, step-by-step procedure for investigating child abuse by burning. This algorithm, illustrated in Figure 1, begins with the elicitation of history from the caregivers and examination of the burns.

If there is a concern about child abuse, the subsequent steps include a detailed, chronologic history, a comprehensive physical examination, exhaustive documentation, and communication with CPS and law enforcement. The denouement of the algorithm is preparation for testimony at hearings and trials. The subsequent discussion will serve to elucidate the steps of the algorithm.

DISCUSSION Historical Perspectives

The battered child syndrome was first described by Kempe and associates in 1962.⁸ Although Kempe et al. described physical injuries to the bones, soft tissues, and the head, there was soon appreciation that nonaccidental burn injuries occurred frequently. For example, Stone and associates described 26 cases of child abuse by burning admitted to Cook County Hospital (Chicago, IL) between 1965 and

Table 1 Characteristics of Abused Children^a

Infants or preschoolers
African-American children in single-parent families
For children younger than 18 mo, inconsolable crying was precipitating factor
For preschoolers, toilet training or toilet accident was precipitating factor
Parent-child bonding impaired or challenged by prematurity, mental retardation, congenital anomalies, or other condition of the child
Adolescent parents
Poor parent-child interactions observed in interactions, such as role reversals
Child manifests inappropriate behavior such as clinging, excessive or absent crying, apathy, and lethargy
Previous record of investigation by CPS
Child has poor record of immunizations, and preventive and acute health management

^a Data from Weimer et al.² and Warner and Hansen.⁴

1969.⁹ Subsequently, Hight and associates reported 1,518 cases of child abuse over the 6-year period 1972 through 1977 at Children's Hospital of Michigan; 142 (9.3%) of these were abuse by burning.³ Feldman and associates reviewed charts from two Seattle hospitals covering the period 1963 through 1976 and found that 26% of scald burns in children were because of child abuse by burning.¹⁰ In a more recent review, Montrey and Barcia observed that child abuse by burning accounted for 25% of pediatric admissions to the Tripler Army Medical Center (Honolulu, HI).¹¹

Over the years, studies of abused children have generated profiles of the abused, the abuser, and the environment. Before summarizing these findings, however, it is crucial to emphasize that child abuse can occur in any family, and the responsibility for investigation is no less during evaluation and treatment of a burned child of white, married, middle to upper class parents.

Often there are multiple risk factors that lead to the impulsive act of violence. For example, most children abused by burning are between the ages of 1 and 3 years, a developmentally taxing period that strains the best of parents, much less those who are already stressed by minimal physical or emotional resources.³ The characteristics of abused children and abusers are summarized in Tables 1 and 2, respectively.^{2,3}

Table 2 Characteristics of Abusers^a

Parents were abused or neglected themselves
Parental expectations are inconsistent with normal child development
Parents tend to lack external support systems and be isolated
Stressors such as substance abuse, unemployment, substandard housing, and mental illness
Poor impulse control
Parents rely on children for emotional support (role reversal)
Parents use violence in their interactions with each other
Low-income, single-parent families where mother is head of household

^a Data from Weimer et al.² and Hight et al.³

Recognition of Cases

Recognition of child abuse by burning is difficult because the injuries occur most frequently in very young children without verbal skills. Nonetheless, the word of a child who communicates that he or she has been abused by burning must absolutely be respected, and the child should be kept in the hospital or in another safe environment (grandparents and other family members are *not* safe options unless the situation has been cleared by social services) until the investigation is complete.

The difficulties of recognizing child abuse will be compounded by the abuser(s) and the "passive participant," such as a spouse in denial.² Rarely have we or others encountered an admission of guilt by the abuser. Even then, the admission of guilt occurs at a time during the investigation so long after the injury that it does not help the initial evaluation.

As early as 1970, Stone and associates described clues that are helpful in alerting the attending surgeon, pediatrician, or emergency room physician to the possibility of abuse.⁹ Although modified by others over the years, these findings stand today as helpful clues. These clues, such as evidence of other injuries or of malnutrition and neglect, help define the first step in the algorithm (Fig. 1), which is maintaining a high index of suspicion during the history from the caregivers and physical examination of any child with burns.

Although most investigators have found no correlation between size of burn and the likelihood of abuse,^{10,12} some patterns are pathognomonic of child abuse by burning, such as clearly demarcated, deep scald burns of the buttocks, perineum, and feet, particularly if the burns of the lower extremities are symmetric.^{12,13} In addition, the routine use in the emergency department of a screening tool, such as the 13-factor criteria developed by Hight and associates,³ increases effective social service referrals for burn abuse.¹⁴

Responsibilities of Physicians

The physician's role in child abuse investigations is multidimensional. At its most elementary level, the physician's role is to diagnose and treat the burn injury. If there is no index of suspicion, diagnosis and treatment become the physician's primary focus. However, as soon as clues pointing to abuse are revealed, the responsibilities of the physician expand quickly.

A word of caution is in order. Physicians have made statements ruling out abuse or neglect solely on the basis of their personal opinion of the parent's character. In the best interest of the child's safety and welfare, innate judgments based primarily on the appearance or status of the caregivers, or the fact that they may seem inattentive to their child's needs, are insufficient to conclude whether the child was abused or neglected.¹⁵

History and Physical Examination

The first question that the attending physician should ask is, does the pattern of injury match the history given? Al-

though the diagnosis of abuse from other causes can be made almost solely on the basis of the history given by the parents or child,¹⁶ there are many circumstances related to burn injuries that can create a pattern of injury that is difficult to interpret. For example, the depth of burn is often difficult to diagnose in the first 24 hours. Repeated examinations over the next few days are often necessary, particularly to delineate burned from unburned skin.¹³ Moreover, the pattern of injury, although not consistent with the history given, does not always readily lend itself to an explanation. In fact, Hammond and associates found that in the absence of other findings suspicious for abuse (e.g., delay in treatment or injury inconsistent with the child's developmental or chronological age), the positive predictive value of the discovery of an injury inconsistent with the history of the accident was only 40%—that is, 60% of those childhood burns for which the physician cannot match the history with the pattern of injury are later found to be because of negligence or accident.¹⁷ For example, we often find in cases of neglect that the child was left unattended, and the parent truly has no idea how the child was burned; nonetheless, on initial presentation the parent often fabricates an excuse or alibi to avoid the accusation of negligence.

There are patterns of injury that are characteristic, although not diagnostic, of child abuse by burning. Classic examples include deep second- or third-degree burns of the hands or feet in a glove- or stocking-like distribution, particularly if the burns are symmetric.^{12,18} Another example characteristic of child abuse is isolated contact burns of the buttocks in infants, especially from a hot object such as an electric hot plate, which infants are incapable of climbing on without sustaining burns to palms or other parts of the body.⁹ Scald burns isolated to the buttocks and lower extremities should also arouse suspicion. Montrey and Barcia found that 64% of abused children were burned on the buttocks and lower extremities, whereas only 29% of accidentally burned children were burned on these areas.¹¹ In contrast, 43% of accidental scalds in their series resulted in burns to the face and trunk, compared with only 12% of burns by abuse. Nonetheless, intentional scald burns poured down on the child from above occasionally occur.

Patterns of the majority of inflicted burn injuries were grouped by Lenoski and Hunter into four categories: immersion burns, splash burns, flexion burns, and contact burns.¹⁹ Immersion burns are of a uniform depth, with a sharp, straight line of demarcation between burned and unburned skin. (The exception to this axiom is when the child is immersed twice—the “double-dunk” injury.) A child who accidentally places a hand or foot into hot water will withdraw from the painful stimulus, creating splash marks and a poorly demarcated line of burn. Some areas—such as the sole of the foot or the buttock—may remain unburned because this area has been held in contact with the wall of the container (e.g., the side or bottom of a bathtub). Sparing of the buttocks gives rise to a “doughnut” appearance to the wound. By positioning

the child so that the lines of demarcation are parallel, the position of the child during immersion can be estimated, thus lending credence or doubt to the history.

Splash burns result when the scalding agent is thrown or poured on the victim. Although not uncommon in adults, this mode of assault is fortunately rare in children.¹³ Splash burns are characterized by a more heterogeneous distribution of burn depth than immersion burns, and the lines of demarcation are not clear. In fact, drip, run, or spill patterns are seen. The water running down under the force of gravity will leave an “arrowhead” pattern that can be used to estimate the position of the child when injured. Intentional splash burns are difficult to differentiate from accidental splash burns, but accidental splash burns tend to involve the upper extremities, the face, and the trunk.¹¹ For example, the classic spill burn that occurs when a child has pulled down a container of hot liquid usually involves the anterior face, head, and neck; palmar surfaces of hands and fingers; extended arm; and anterior shoulder, axilla, and chest.²⁰

Flexion burns occur when the victim is holding joints in flexion, from fear, pain, or anger. These are typically noted with immersion burns, and involve the flexion creases of the hips anteriorly or the knees posteriorly in the popliteal fossae. Paradoxically, forcing a young girl into a bathtub of hot water with the express purpose of disciplining or punishing for toilet accidents may force the legs into abduction as well as flexion at the hips, leaving the intertriginous folds in the groin pulled apart so that the labia majora are scalded as well. (Forced immersion burns in boys almost always result in burns of the external genitals.) More often, the spared creases include the lower abdomen in horizontal strips where the lower trunk is forced also into flexion.

Contact burns are characterized by the configuration of the burning object. Intentional injuries are more sharply defined than accidental ones, because the victim has less opportunity to move about in reaction to the pain.¹³ As mentioned above, the developmental stage of the child has to be taken into account when evaluating contact burns. Police investigation of the crime scene should seize any objects that could fit the pattern of the contact burn.

As technology in the home advances, the types of injuries inflicted will change. Hair dryers can produce heated air currents up to 110°F temperature, and the heated grill over the end can hold enough heat to inflict full-thickness burns for up to 2 minutes after the dryer has been turned off.²¹ Microwave burns are also recent and fortunately rare causes of child abuse by burning.²² Because of the characteristics of microwave radiant energy, sparing of subcutaneous fat can occur. The thermal injury is thus confined to the skin and skips down to the muscle, which can be deeply burned. Peculiar skin distributions of burns should alert the physician to the possibility of child abuse by burning in a microwave oven. The diagnosis can be confirmed by a deep biopsy of the burned tissue down to and including underlying muscle.

Initiating the Investigation

When participating in the investigation of alleged child abuse, it is important for the clinician to remember that the standard of scientific logic, inductive reasoning, is not as useful as forensics in preparing for legal proceedings. Forensics, defined as the application of scientific methods and principles to the solution of legal problems, keeps in the forefront at all times the importance of collecting evidence to be used in court. An open mind is the most important prerequisite, as is a commitment to not rush to judgment until the data are collected from all sources, for example, social workers, child protective service workers, detectives, and heating systems engineers.

Once child abuse by burning is suspected, the physician is obligated by law to inform the CPS or police or both. However, this does not bring to an end the responsibilities of the attending physician. Further work by the physician has to be performed to clarify the cause of injury, to treat other injuries or associated conditions, and to prepare for testimony at hearings or trials.

Radiographic Examination

Subsequently, the physician decides whether or not to order a skeletal survey. The skeletal survey should be a routine part of the medical evaluation of children less than 2 years old when there is suspicion of physical abuse. Between the ages of 2 and 5, the survey should be performed selectively, on the basis of the history and physical examination. Because hidden fractures are rare beyond the age of 5, the survey is of little diagnostic value for older children. In general, the less the child is able to tell about where he or she hurts, the greater the value of the skeletal survey.²³

Thirty-five percent of children that are detected as abused have new or old fractures or both.²⁴ Approximately 30% have other documented injuries, such as bruises, fractures, central nervous system damage, or malnutrition. From 1992 through 1994 at the North Carolina Jaycee Burn Center, 43% of child abuse and neglect cases had other stigmata of abuse on examination.⁷

Nonetheless, some physicians are reluctant to subject a child to x-rays just to collect evidence of prior abuse because they do not want to expose the child to potential carcinogenic hazards. Some would suggest a need for radiographic examination only if there are complaints of pain or physical symptoms that indicate the need for a radiographic examination.²⁴ Other physicians believe that additional proof of abuse is superfluous to the goal of being able to protect the child if the burn pattern itself already presents unchallengeable argument for abuse. Unfortunately, conviction of felonious child abuse requires that the alleged perpetrator's peers on the jury be convinced beyond a reasonable doubt of his or her guilt. Thus, there is forensic justification for the routine performance of radiography of long bones and ribs to screen for signs of other nonaccidental injury.

Forensic Photography

Forensic photographs are taken of all the injuries. It is important that the quality of the photographs be high because they are typically used in court to illustrate the nature and pattern of the burns. Professional photographers should be used if available because their results are higher quality than those obtained by most clinicians. Principles to follow include the following:²⁵

- Use a 35-mm camera. (Digital images may be easily altered by software programs, thus raising doubt about their veracity.)
- Try to avoid flash glare or reflection. Consider high-speed film.
- Take a face shot for identification and include the patient's medical record number visible in the photograph.
- Take a full body shot, both front and back, to put the burns in context.
- Take photographs at various stages of healing, such as at initial presentation, and then several days later when the burn depth is unequivocal. Date the photographs for future reference.
- Use a scale or ruler next to the burn to show its dimensions, especially the height of the water line.
- Photograph the margins of the burns.
- Photograph the burns from all angles.
- Photograph areas of sparing and then photograph the child in the flexed position to demonstrate how flexion caused the sparing.
- Sign and date the identified photograph.

Assessing Technical Information

It is important to question whether the CPS worker or the detective has previously handled investigations of child abuse by burning, and also whether they have had any formal forensic training in this area. In our experience, the majority have had either minimal or no experience or training in investigations of child abuse by burning.

This lack of experience and training places a greater burden of responsibility on the attending burn surgeon because his or her opinion will thus likely carry greater weight with CPS and police investigators. It is therefore necessary for the attending burn physician to honestly examine his or her own level of expertise before rendering an expert opinion.

Regardless of the previous level of training or experience of the attending surgeon or the field investigators, the next step in the algorithm is for the surgeon to obtain specific technical information from those that have personally assessed the alleged crime scene. Technical information in a scald injury, for example, includes the type of liquid, temperature of liquid, exposure time, volume of liquid, water temperature of the hot water heater, water temperature from the faucet, and container material.

When the reported mechanism of burning is hot tap water, it is important that the water temperature be properly and accurately measured. It is also important to have these

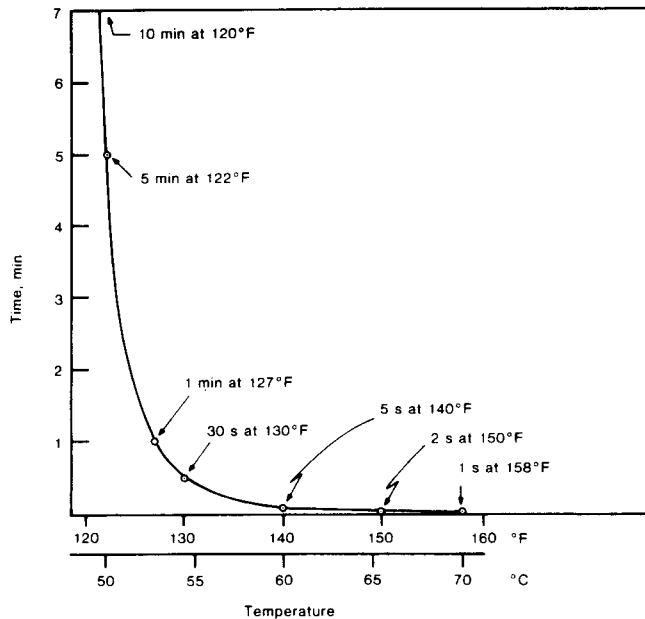


Fig. 2. Relationship of water temperature and time of exposure to burn depth. This graph demonstrates the duration of exposure required at different water temperatures to cause superficial partial-thickness burns of adults. (Derived from original data from Moritz and Henriques,²⁶ and reproduced from Katcher ML. Scald burns from hot tap water. JAMA. 1981;246:219–222, with permission.)

investigators contact the homeowner or landlord immediately after the case is reported so that no one is allowed to change the temperature of the water heater. The temperature of the water is critical to corroborate the history. For example, water that comes out of the tap at 120°F will not instantaneously produce a full-thickness burn. The water temperature measurements should be taken under the same conditions as when the burn injury occurred. The relationship between water temperature and time necessary to inflict a superficial partial-thickness burn derived from the classic work of Moritz and Henriques in 1947 is illustrated in Figure 2.²⁶

The investigators at the scene of the injury must recognize that vital information is needed to confirm the relationship between the pattern of injury and the history given. Specifically, for immersion burns, the temperature of the tap water should be taken at different times as the water runs from the spigot, such as every 5 seconds; in addition, the investigator should note the type of water heater, discrepancy between the set water temperature and the actual temperature, measurements of the dimensions of the tub (including how high the child would have to climb from the floor to get into the tub), the distance to the spigot, and the design of the faucet.^{18,27}

Responsibilities of Social Workers

A social worker who is forensically trained and is experienced in assessing child abuse by burning plays an invaluable

role in a multitude of systems, both within the hospital and without. Often, the social worker is the first to perform an in-depth interview of the child victim and the alleged perpetrator.

Hospitalization of the child for treatment of burn injuries is a unique window of opportunity for these interviews because, during the crisis of admission, emotions tend to run their highest. Disclosures and statements during the first interview may be made before the suspect has time to construct a more convincing story or alibi. As is often seen in child abuse investigations, the story changes over time. It is not uncommon for the parent to give several versions of the events. A thorough event reconstruction performed soon after admission gives the suspect little room in which to maneuver in future attempts to embellish his or her story. What is shared with the burn center social worker can then be compared for consistency of detail in other interviews performed by the CPS worker and the police.

Psychosocial Assessment

The social worker interviews the parent/caregiver for a full psychosocial evaluation, with particular attention to the following risk factors associated with child abuse:

- Single-parent family
- Relationship discord
- Financial stress
- Social isolation
- Employment difficulties
- Substance abuse
- Domestic violence
- CPS history
- Role reversal in childcare responsibilities (mother works, father or boyfriend is unemployed and provides the childcare while the mother is at work)
- Twins or disabled child
- Inappropriate expectations of the child given the child's age
- Other evidence of maltreatment
- Poor bonding
- Chaotic, erratic lifestyle
- Delay in seeking medical care
- History of fluctuations in water temperature

In addition, Hammond and associates have found that language deficits, both receptive (i.e., comprehension and memory) and expressive (i.e., naming and description), are present in 81% of children abused by burning, but in only 42% of those burned accidentally.²⁸

Event Reconstruction/Enactment

The social worker has the alleged perpetrator describe in detail how, where, when, what, and who was present when the burn occurred. The social worker carefully charts the chronology of events leading to the burn injury as well as the event itself and what transpired afterward. The scene is reconstructed and verbatim notes are taken. The notes are

reviewed for accuracy by the interviewer and suspect after the interview is completed. The suspect initials each page and signs a brief statement on the last page verifying that he or she reviewed the notes, and that errors were corrected. He or she signs and dates the statement. This prevents future disclaimers of inaccuracy. Props such as flexible dolls and basins substituting for a bathtub, as well as re-creations in an actual bathroom, can be used to facilitate the reenactment.

Burn Pattern Assessment

The experienced burn center social worker adept at assessing burn patterns views the burn wounds and writes his or her own chart note on the basis of his or her own observations. Viewing the wounds can be done with the attending burn physician, with the consulting child abuse team physician, or separately with nursing. In addition, the health care workers note other stigmata indicative of maltreatment, and the parent or caretaker is asked to explain each bruise, scar, or injury.

The burn pattern is discussed with other burn team colleagues in relation to the comprehensive history, technical data from the crime scene, the psychosocial assessment, the child's disclosures, witness reports, and behavioral indicators. The attending physician evaluates and considers all of the data before a final determination is made.

Technical Information

The social worker is the liaison among the burn team, CPS, and the police. After ascertaining that one or both investigative agencies has no or minimal experience, the experienced burn center social worker shares resources and reference materials to assist them in their mandate. Such information may include temperature/time exposure charts, illustrations demonstrating burn patterns typical of nonaccidental trauma, relevant articles, investigative checklists, and referrals to expert resources such as heating systems engineers or other police officers skilled in forensic investigations of child abuse by burning.

Responsibilities of Nurses

In addition to the traditional role of the nurse in providing optimal patient care, the nurse can and does play an important role in a team forensic approach. The nurse performs a careful examination at the time of admission to document all bruises, bites, lacerations, scars, and other marks in the medical record. The nurse also informs the physician and the social worker of all new findings and concerns.

Documentation in the medical record by the child's nurse can be absolutely critical to the outcome of the case. Acts of both omission and commission need to be documented. Acts of omission include the parent's absence on a day when they stated they were going to be present, or the parent's absence at the time of critical events (such as surgery or sepsis). Acts of commission include the quality of interactions between

parent and child, the number of times physical contact is made with the child, the content of discussions and questions, and general remarks about behavior.

Bakalar and associates have noted that poor parent-child relationships correlate with injury rates and behavioral problems in children.²⁹ For example, 49% of charts of children admitted to the Burn Center of Children's Hospital of Michigan between 1972 and 1978 who were abused by burning record poor parent-child interactions, and 41% of these parents visited twice a week or less. Indeed, 12% never visited or telephoned during the hospitalization. This information can be useful not only in the criminal trial of abuse but also in the subsequent civil trial for custody, so that the child is not returned to the "passive participant," the enabling spouse who is also unable to provide for the protection and emotional needs of the child.

The nurse is in the unique role of spending the most time with the patient and his or her family. During the routine of dressing changes and other nursing care, the patient and/or family may well disclose information important to the investigation. Verbatim documentation in the medical chart as well as sharing what was said with team members is vital. The nurse should use quotes from patients and significant others whenever possible; these are called "excited utterances" and can be important in legal proceedings.²⁵

In addition, the nurse observes the nature of the child's behavior as well as the parent-child interaction, and carefully notes his or her observations in the progress notes. The nurse should perform the following assessments of child behavior:

- Does the child cry with painful procedures, or is he or she stoic as if used to such encounters?
- Does the child relate well to others emotionally or does he or she protect him- or herself from the world, such as hiding beneath the blankets?
- Does the child seek comfort indiscriminately from others?
- Does the child appear closed off within him- or herself?
- Is the child withdrawn or aggressive?
- Does the child show signs of developmental delay?
- Is the child overly anxious or fearful?
- Is the child passive when invasive procedures are performed?

The following assessments of parental behavior should be noted:

- Does the parent comfort the child, or is he or she too absorbed in other self-directed activities, such as watching television or talking on the telephone?
- Does the parent direct debasing, insulting, mean, or hateful comments to the child?
- Does the parent use or threaten to use corporal punishment with the child for noncompliance?
- Does the parent arrive on time when promised to the child, or is there a pattern of inconsistencies and broken promises?

- Does the parent show impatience or annoyance when the child cries?
- Does the parent show appropriate concern or judgment?
- Is the parent present whenever possible?
- Does the parent exhibit signs of alcohol or substance abuse when visiting the child?
- Does the parent have hostile or inappropriate behavior toward the medical staff?
- When present, does the parent participate in the child's care, or does he or she expect the nursing staff to change diapers, feed the child, and perform other aspects of usual child care?

The above behaviors are all warning signs that should be considered in making the diagnosis of child abuse by burning. By virtue of his or her accessibility to the patient and family, the nurse plays a crucial role in observing and assessing these behavioral indicators for abuse.

Avoiding False-Negatives and False-Positives

Warner and Hansen have labeled the four stages of identifying and reporting abuse as assessment and evaluation, identification, reporting, and validation.⁴ False-negatives are abused children who are not reported to CPS; false-positives are accidentally injured children who are incorrectly identified as abused. As mentioned above, the former is dangerous to the child, but the latter is emotionally damaging to the parents.

False-positives may occur because of difficult diagnostic differentiations, such as injuries or disease conditions that may be confused with child abuse by burning. One example is bullous impetigo, which can present as round, deepithelialized or crusted, tender areas that may appear like cigarette burns.^{18,30} Impetigo tends to heal from the center outward, and also responds quickly to appropriate antibiotic treatment. Lesions of bullous impetigo also tend to be grouped and heal without scarring, unlike cigarette burns.³¹ Similarly, phytophotodermatitis (solar keratosis from plants) can result in a severe erythematous reaction that mimics a partial-thickness burn.³² Another example is a burn that is intentionally inflicted for "therapeutic" reasons by a traditional healer, as Forjuoh has observed in Ghana³³ and Feldman has observed in Asian refugees to the United States.³⁴ Occasionally, dry pressure injuries caused by infant swings, cowboy boots, or elastic pajama cuffs have been mistaken for child abuse by burning.³⁵ Car seats can cause confusing burns in hot weather.^{35,36} Finally, there are reports of congenital indifference to pain, which has been mistaken for child abuse by burning.³⁷

False-negatives may occur because physicians do not report the suspicion of abuse to CPS, or because they fail to identify abuse; unfortunately, as many as one third of child abuse cases remain undetected or unreported.⁴ Since 1970, each state has had a reporting law that specifies who must report, to whom reports should be made, and the information included in the report.³⁸ Thus, because of these laws, the

number of cases identified should equal the number reported. Again, there is an unfortunate discrepancy, with only 89% of identified cases reported in one study.³⁹ It is important to remember that state laws do not insist on a certain diagnosis of abuse before reporting, but only a reasonable cause to suspect.⁴

Regarding failures by physicians to identify child abuse by burning, identification of physical abuse is a discriminative task, and as such may depend on medical training, clinical experience, and other factors.⁴ Although diagnostic certainty does not have to be established before the case is reported, a significant number of physicians will not report abuse unless they are certain of the diagnosis.^{39,40} Additional factors that may influence the physician's decision to report a suspected case of child abuse include the physician's status as a parent, his or her views on acceptable methods of discipline, and a personal history of abuse.⁴ Other physician-related factors that are positively correlated with improved ability to discriminate child abuse are formal medical training, either in medical school or residency, training in child development, clinical experience with pediatric patients, and specific training related to the reporting procedure.⁴ Factors negatively influencing the likelihood of reporting include concerns about the additional time required to manage child abuse cases, fear of malpractice suits or family retaliation (particularly in smaller communities), reluctance to become involved in the court system, and a history of negative interactions with CPS.⁵

Other factors include demographic variables related to the abused child. Hampton and Newberger found that child abuse is more likely to be reported for younger children, for children of African-American and Hispanic families, and for children of families with an annual income of \$25,000 or less.⁴¹ These children are more likely to present to public hospitals or clinics, where the incidence of physician reporting is also higher: physicians in private practice are less likely to report abuse.⁴

Preparation for Testimony

Although it is not the hospital's responsibility to decide whether the alleged abuser is guilty or not, the most expedient approach to protecting the abused child from further harm and to ensure the continuity of medical care after discharge is to facilitate the legal process. Once the child's medical needs have been met, the next most important priority is ensuring that an abused child is not returned to the same environment. The risk of recurrent severe injury and even death is extremely high, so high that the investigating team should err on the side of protecting the child, rather than sympathizing with the alleged, and possibly innocent, abuser. The legal system in the United States is founded on the principle of protecting the innocent (in this case, the alleged abuser), and the burden of proof rests on the shoulders of the prosecuting attorney, and thus indirectly on those of the medical investigators.

The final stage of child abuse reporting, in fact, is validation of abuse. Experience shows that physician reporting has an important impact on validation. For example, CPS agencies are most likely to substantiate cases reported by physicians compared with other sources of reporting.^{41,42} Warner and Hansen cite a number of factors that may explain why physician reporting has such an impact on validation rates, including more accurate discrimination abilities on the basis of medical training and experience and a higher threshold for diagnostic criteria before reporting.^{4,42} In addition, the physician's standing in the community also influences the decisions of CPS workers investigating the cases.⁴

Frank and honest discussions between the health care providers and the prosecuting team are invaluable as the case progresses. In some metropolitan areas, the county district attorney's office may unfortunately have had ample experience with prosecuting child abuse cases. In other situations, such as our own in largely rural North Carolina whose 7 million inhabitants are spread throughout 100 county jurisdictions, the district attorney's office may have had little experience with child abuse in general, and none with child abuse by burning. The expertise of the medical investigators can thus provide the foundation for a case full of factual testimony that will lead to the truth.

Physicians accept two roles when addressing the court. First, we present ourselves as experts in both the diagnosis and treatment of child abuse. Most physicians, particularly burn surgeons, have no trouble convincing the court of their expertise in the latter, but sometimes inadequate attention is given to establishing the experience of the physician-witness as an investigator of child abuse by burning. Accurate citations of the number of child abuse or neglect cases investigated, as well as previous testimony in child abuse cases, will help establish this expertise in the court's mind. Evidence of peer-reviewed publications about clinical aspects of burn care, especially those pertaining to child abuse by burning, are also helpful to document expert status of the health care professionals when giving testimony. Evidence of actual forensic training is also invaluable in establishing expert witness credibility.

The other role of the health care provider in court is that of a teacher. Although some judges are acquainted with aspects of child abuse, the best approach is to assume an absolute lack of knowledge by the court, especially the jury, about diagnosing and treating burns. Mannequins, reconstructed drawings, and slides of the acutely burned child are helpful for illustrating key points in the case.¹⁹

Treating the Abuser

The sad truth of child abuse is that often the abuser is doing what he or she believes to be the customary way of raising children, because that is how the abusers were raised. Corporal punishment as a form of discipline is still common in many parts of the country, and the transition from punish-

ment to abuse is often poorly defined. In addition, many abusive parents were victims of abuse or neglect themselves.³

Nonetheless, the investigation of child abuse by burning is an emotionally exhaustive one for all concerned, and hospital personnel can easily become enmeshed in the dysfunctional family dynamics to the point where dispassionate, objective investigation is impossible. Although we are reminded that the "abusive family" requires treatment as a unit,⁴ we recommend that physicians minimize the contact with parents to focused conversations regarding the child's medical condition, treatment, and prognosis. Evaluation and management of the family is best left to the social worker who, although detached and objective, is in a better position to establish rapport with the family. It is possible to explain to the parents the process of investigation that must take place in such a way that the foundations for a therapeutic alliance can be established.

The primary goal is to prevent the child from being injured again. Whether or not the abuser should be punished is a legal, and not a medical, decision. Once the medical investigation has ended, it is appropriate to explore treatment for the abuser. Unfortunately, there is rarely an admission of guilt from the abuser, and without an honest admission from the abuser, further treatment will be difficult.

We have on occasion confronted the alleged abuser with our assessment after reporting it to the proper authorities. Our presentation is matter-of-fact and without judgment; we simply state that an investigation fueled by such findings as we have observed will likely lead to a trial by jury, if not imprisonment. We have suggested to alleged abusers that an admission of guilt would not only ease the legal path ahead, but would allow us to make appropriate referrals for treatment. In the end, we may accomplish what may be the most difficult step of all, communicating to the abuser that despite his or her horrific act, we recognize they are in need of help.

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