

Cutaneous Manifestations of Child Abuse

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Abstract: Dermatologists and child abuse are not frequently associated in the minds of most physicians. Yet the most common manifestations of child abuse are cutaneous. This article reviews cutaneous manifestations of physical abuse, including bruises, lacerations, abrasions, human bites, and burns. It also discusses ways that dermatologists can differentiate abusive injuries from accidental ones as well as from the many dermatologic conditions that can mimic child abuse. Finally, we review what actions the dermatologist should take when suspecting abuse in a patient.

Child abuse is a topic that makes most physicians uncomfortable, partly because of having little or no training in recognizing the problem. For most dermatologists, abuse rarely appears on the list of differential diagnoses, yet cutaneous findings are the most common and most easily recognizable manifestations of child abuse (1). Recognition of child maltreatment is integral to ensuring the abused child's physical and psychological well-being and at times even survival. The purpose of this review article is to acquaint the dermatologist with the various cutaneous findings of abuse as well as raise awareness of this prevalent problem.

In 1974, the Federal Child Abuse Prevention and Treatment Act (CAPTA) was passed, requiring mandatory reporting of abuse in every state by personnel such as physicians and educators. That same year, 60,000 reports of suspected abuse were made, but by 2001, this figure had increased to 2,672,000, of which 903,000 were later substantiated, according to the National Child Abuse and Neglect Data System. This figure included 1300 fatalities (2). The rapid rise is thought to be mainly because of improved recognition and reporting. It is, however, still estimated that for every one victim reported, two go unrecognized and/or unreported. Recogni-

zing child maltreatment early in its course is imperative as 30% to 70% of abused children are at increased risk of subsequent injury, and minor forms of abuse may lead to severe abuse unless interventions are made (3). There are four major types of abuse: physical abuse, sexual abuse, emotional abuse, and neglect. This review will focus on physical abuse, as it most commonly has cutaneous findings.

HISTORY TAKING

As physical evidence of abuse may be hard to interpret, it is imperative that the physician be aware of red flags in the history given by the caretaker. Lack of or vague explanation for an injury, history that changes with time, and delay in seeking medical care for anything but minor injuries should raise suspicion of abuse (4–7). A history of repeated emergency room visits and/or repeated fractures and injuries is another red flag (7). A history inconsistent with the physical findings is a hallmark of abuse (8). In assessing the plausibility of the history, it is important to keep in mind the developmental stage of the child as this can be used to corroborate or reject the history. Accidental injuries require certain motor skills

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and should be appropriate for the child's stage of development. Thus, a child who reportedly fell down the stairs should be old enough to be at least crawling.

CUTANEOUS FINDINGS IN PHYSICAL ABUSE

The skin is the most commonly involved organ in children with accidental or nonaccidental injury (9). Up to 90% of victims of physical abuse present with skin findings (10). Cutaneous manifestations of abuse include bruises, lacerations, abrasions, burns, oral trauma, bite marks, and traumatic alopecia.

BRUISES, LACERATIONS, AND ABRASIONS

Although bruising is the most common physical sign of abuse, it is also a frequent finding in any active child (9,11,12). Accidental bruising most commonly occurs over the knees and anterior tibial area (13,14). It can also be seen over any bony prominence, such as the forehead, hips, lower arms, and spine. Bruising over relatively protected sites such as the upper arms, medial and posterior thighs, hands, trunk, cheeks, ears, neck, genitalia, and buttocks should raise suspicion of abuse, especially if the bruises are extensive and of varying age (Fig. 1; 15).

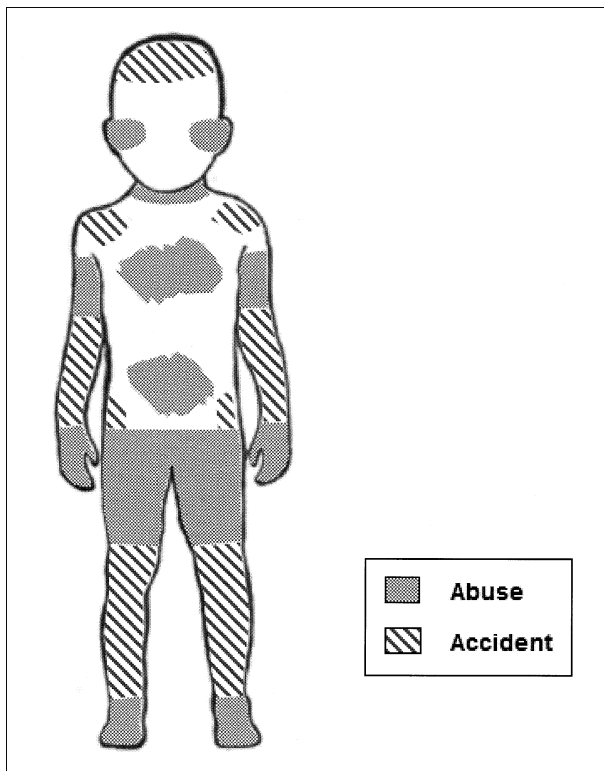


Figure 1. Common anatomic sites of abusive versus accidental bruising.

Bruising of the genitalia and ears is highly suspicious for abuse as these areas are rarely injured accidentally (15,16). Abdominal bruising rarely occurs due to the flexibility and padding of the abdominal wall, but when present is usually indicative of forceful grabbing or very forceful blunt impact. If abdominal bruising is noted on examination, the physician must also look for associated internal injury (7). Accidental bruising of the head and face is uncommon in preambulatory infants as well as in school aged children, but it is more common in toddlers, as they are not yet steady on their feet (17). However, no site is invariably spared in accidental bruising, and therefore site is not a pathognomonic characteristic in itself. One should keep in mind that injuries in sites more common to accidents can be abusive in origin.

The physician must also consider the age and development of the patient. Studies have found that bruises are extremely rare in babies < 6 months of age, as they are not yet mobile. Thus, any single soft tissue injury in a preambulatory infant has a high correlation with abuse. There is a highly significant increase in accidental bruising with increases in mobility, especially over the shins and forehead (13,14). This includes babies in walkers, who often have bruises on their upper legs and shins.

Another helpful factor is the shape of a bruise, which can reflect the shape of the object used to inflict it (Fig. 2). Pattern bruising is a strong indicator of abuse. Linear bruises are produced by objects such as rods, switches, or wires. They are usually found over the buttocks, posterior legs, and back (16). Loop marks are pathognomonic for abuse and result from striking the child with a doubled-over flexible cord such as an extension cord, rope, or belt (Fig. 3).

Another pattern mark is seen in slap and grab injuries. Bruises in the shape of finger marks, often seen on the upper arm, indicate the child was grabbed forcefully. When a child is slapped, blood is forced laterally by the fingers, extravasating and leaving an outline of the fingers while the actual point of impact is white. This phenomenon can be seen in any high velocity injury, such as whippings and slaps. Spanking the child on the buttocks can also produce characteristic vertical bruises along the gluteal cleft secondary to the shearing damage to the vessels along the convex curvature of the buttocks (7,18).

Circumferential bruises or abrasions around wrists and ankles implicate binding injuries. This type of injury can also result in distal petechiae and edema. Similar marks can be seen at the oral commissure if the child has been gagged or around the neck after attempted strangulation. Because of their location and shape, these marks are highly characteristic of abuse.

Dating of bruises has been proven to be unreliable and the examiner must be very cautious in making estimates

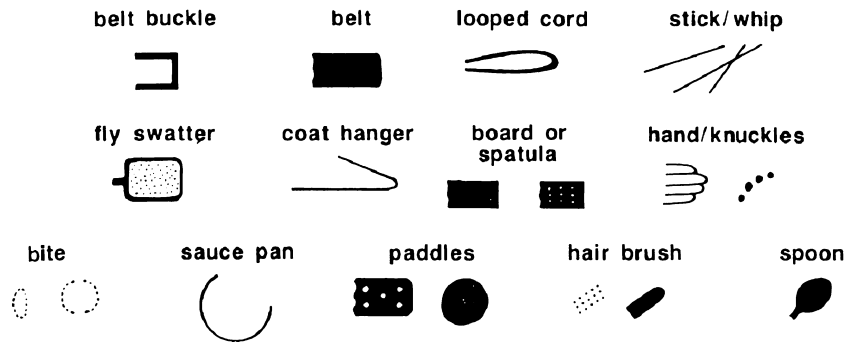


Figure 2. Pattern bruising (from 62).



Figure 3. Pattern bruising: linear bruising reflecting the shape of a hanger on the legs of a 2-year old child.

(19–21). The appearance of a bruise depends not only on its age, but also its site and depth, as well as the complexion of the skin (12,13). Thus, bruises inflicted contemporaneously on one child might not appear the same nor have the same evolution. Recently, Wood lamp illumination has been reported to have an application in

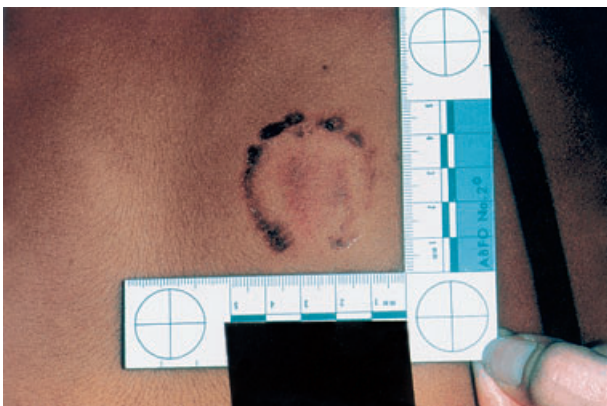


Figure 4. Human bite mark with size standard (from 63).

identifying bruises that are faint or not visible to the naked eye (22).

BITE MARKS

All bite marks should raise suspicion of abuse and lead to full examination of the skin. A classic bite mark is circular or oval (Fig. 4). The canines leave the deepest and most prominent marks. The normal distance between the maxillary canine teeth in adults is 2.5 to 4.0 cm. Therefore, bites with an intercanine distance > 3.0 cm were likely inflicted by an adult. If the distance is < 3 cm, the bite was probably caused by a child (23). With the help of a forensic odontologist or pathologist, the number and pattern of teeth can differentiate an adult bite from that of a child (24,25). A forensic odontologist can also make impression models of the perpetrator's teeth and thus help identify the individual (26).

Animal bites are easily differentiated from human bites as they tend to tear the flesh and produce deeper puncture wounds, whereas human bites compress the flesh and leave more superficial marks, with soft tissue bruising.

Bite marks should be photographed with and without a ruler and with the lens of the camera focused perpendicular to the surface of the skin to prevent distortion. It is also useful to sample the alleged perpetrator's saliva for DNA testing. Prior to any cleansing, all bite marks should be swabbed with a sterile cotton swab moistened with sterile saline, which is then dried, placed in an envelope, and sent to a forensic laboratory for analysis. A second swab used as a control should be obtained from an unharmed area of the child's skin (27).

BURNS

Burns comprise approximately 5% to 22% of physical abuse (3,28–30). Burn abuse appears to be more common in children under 3 years of age (3,31,32). Inflicted burns account for 8% to 25% of all pediatric burns

(3,28,33,34). Burn abuse includes scalds, pattern burns because of contact with various household appliances, flame burns, cigarette burns, and electrical/chemical burns.

Scalds are the most frequent form of burn abuse (3,34). Up to 14% of all pediatric scalds are due to abuse and more specifically 28% to 45% of scalds due to tap water are abusive (6,35). The great majority of intentional scalds (85%) are caused by tap water (3).

Scalds are typically divided into immersion and splash/spill burns. Forced immersion burns tend to be symmetrical and have clear lines of demarcation, often called tide marks (3,36). They also tend to have uniform burn depth and commonly involve the buttocks, perineum, and lower extremities (3). Characteristic features of forced immersion include stocking and glove distribution, zebra stripes, and donut hole sparing (30,32). Stocking and glove burns occur when a child's hands and/or feet are forcibly immersed in hot water, resulting in symmetrical, circumferential, and well demarcated burns. Zebra stripes are due to sparing of the flexural creases secondary to the body's flexed position in the hot liquid. Donut-hole sparing occurs when the child buttocks are pressed against the bathtub which is relatively cooler than the water in it (Figs 5 and 6).

In contrast to inflicted burns, accidental immersion burns, where a child falls into a container of hot liquid, typically have irregular borders and nonuniform depth as the patient is struggling to escape the hot liquid (36). This thrashing also causes splash marks which, although they may sometimes be found in forced immersion, are more characteristic of accidental immersion (32,37). Accidental burns are also rarely full thickness as they typically involve shorter contact time (28). Simultaneous scald burns to buttocks, feet, and perineum are highly suspicious for physical abuse and warrant a thorough investigation, as do well-demarcated burns around the buttocks or bilateral symmetric glove and stocking burns (3,38).

Splash and spill burns are scalds resulting when a hot liquid is thrown at or poured over a child. They often occur accidentally when a child spills a hot liquid and are not a frequent form of abuse. These burns are generally more superficial than immersion burns because the liquid rapidly cools and the time of contact with the skin is short. Associated splash marks are seen more frequently than in immersion burns. Distinguishing between accident and abuse in this type of a burn can be difficult. Both inflicted and accidental splash and spill burns have irregular margins and variable depth (3). They both also have a characteristic appearance, in which the largest and deepest part of the burn is at the initial point of contact,

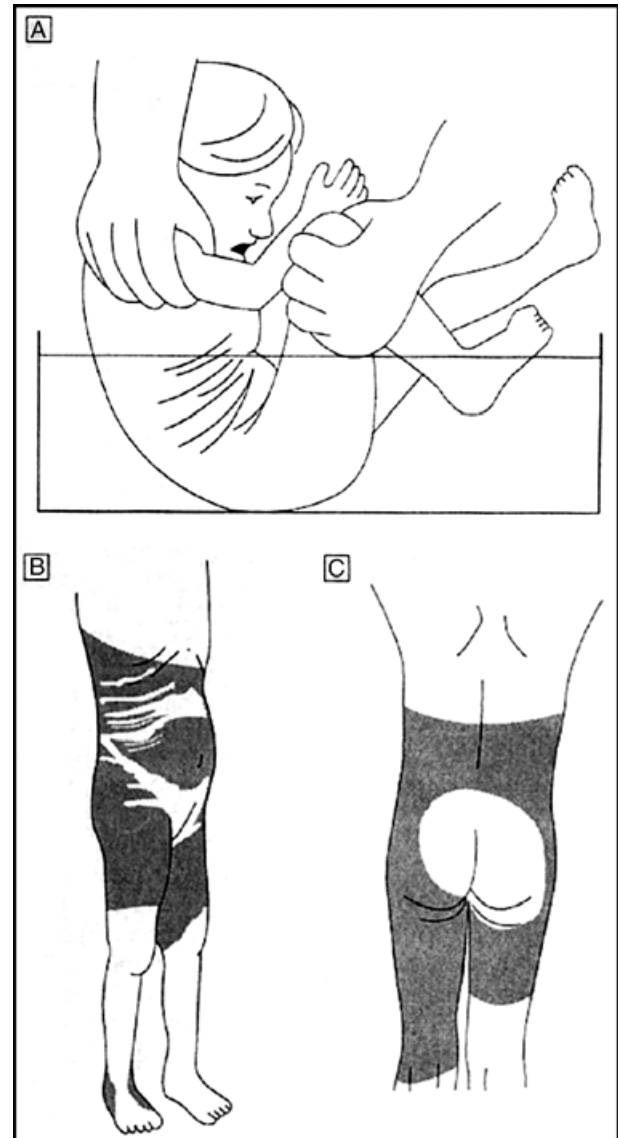


Figure 5. When a child is forcibly submersed in a flexed position (A), the 'zebra stripe' scald pattern (B) or 'doughnut hole' sparing over the buttocks (C) may result (from 64).

usually head or chest, whereas the burn narrows and becomes more superficial as the liquid travels down the body and cools (38,39). Inflicted splash and spill burns are more frequently found on the buttocks and perineum, usually from holding the child under a running faucet. In accidental splash and spill burns, the head, neck, and trunk are commonly involved as the hot liquid is pulled or knocked over from a higher surface and spilled over by the child.

Certain burns have shapes suggestive of the objects used to inflict them (Fig. 7). Accidental contact burns are often patchy and superficial as the child quickly withdraws from the hot object or the falling object brushes



Figure 6. Flexural sparing in a child with a forced immersion scald (from 63).

across the skin. They may or may not show a clear imprint. Inflicted contact burns are deeper, may be multiple, and have well demarcated margins. They are commonly due to hot irons, radiators, hair dryers, curling irons, and stoves (Figs. 8 and 9). Contact burns with uniform depth and well demarcated margins located on typically protected areas of the body suggest abuse (32).

Cigarette burns represent a common form of burn abuse (32). Inflicted cigarette burns appear as 7 to 10 mm round, well-demarcated burns that have a deep central crater (Fig. 10). They heal with scarring as they extend well into the dermis. Cigarette burns commonly appear grouped on the face, hands, and feet (29,30). When accidental, they tend to be oval or eccentric and more superficial, as the child usually brushes against the cigarette (32).

The location of a burn, though not pathognomonic, can be helpful when ruling out abuse (Fig. 11). Face, hands, legs, feet, perineum, and buttocks tend to be predominant sites in abuse. The perineum and buttocks specifically are infrequently involved in accidental burns, and burns in this area are often inflicted as punishment for toilet training accidents (30,32). This is consistent with the fact that forced immersions are frequent in the

infant and toddler age groups (16). In contrast, common locations for accidental burns include the head, neck, anterior trunk and arms, reflecting areas likely to be involved in accidental hot liquid spills. Hand burns can be seen in accidents as well, but the more common site is the palm and anterior surface of the fingers, which would be in contact with the hot object while the child is grasping it. When burns are due to abuse, it is the dorsum of the hand that is commonly involved, especially in contact burns (30,39).

Children with nonaccidental scalds may have additional evidence of maltreatment, such as bruises, fractures, or evidence of neglect, as well as a history of prior burns (3,32,36). Studies have shown that if there is a delay of > 2 hours in seeking medical care for scalds, the injury is more likely to be abusive (6).

ORAL INJURIES

Inflicted bruises, abrasions, and burns can be found in the oral cavity as well. Trauma to the lip occasionally produces large, dome-shaped hematomas instead of macular ecchymoses (25). Unexplained erythema or petechiae of the palate, especially at the junction of the hard and soft palate, may be evidence of forced oral sex (40). Tears of the labial or lingual frenulum can be a sign of a blow to the mouth, forced feeding, or forced oral sex (27,38). A torn frenulum has been said to be diagnostic of abuse, but can occasionally be seen when a child falls on his face (41). Other oral findings of abuse include burns or lacerations in the oral cavity and around the mouth (caused by hot food or utensils) fractured or loose teeth, and signs of dental neglect.

OTHER INJURIES

Alopecia in a child can be traumatic in origin as seen when a parent pulls the child's hair or uses the hair to grab the child. Pulling of hair may lead to petechiae at the site of the pulled hair roots. The scalp may be boggy, a

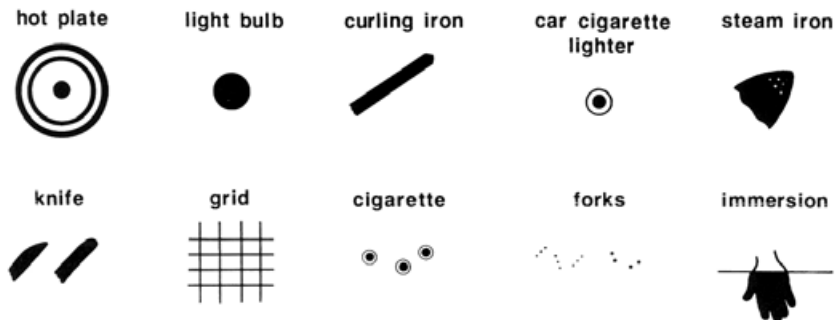


Figure 7. Pattern burns (from 62).



Figure 8. Pattern burn inflicted with a steam iron on the back of an infant (from 63).



Figure 9. Pattern burn on the soles reflecting the shape of a heater grid.

sign of a subgaleal hematoma because of lifting of the scalp off the calvarium (42). Acute scalp tenderness may be present (16).

Finally, petechiae over the head and neck can occur from severe retching or coughing, but have also been reported secondary to neck compression associated with strangulation or holding an infant's neck while shaking (43).



Figure 10. Cigarette burn (63).

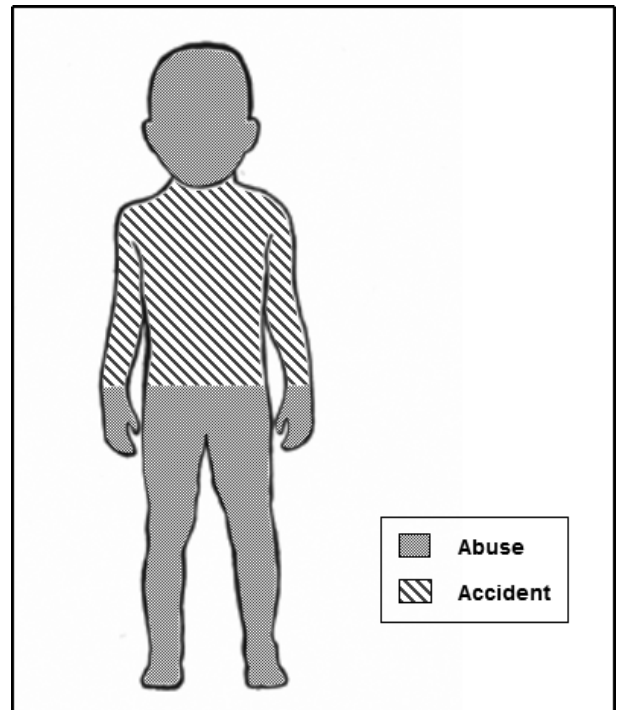


Figure 11. Common anatomic sites of accidental versus abusive burns.

MIMICKERS OF CHILD ABUSE

Mimickers of child abuse are numerous (Table 1). It is important to remember that children with conditions that mimic abuse may also be victims of abuse.

TABLE 1. *Mimickers of child abuse.*

BRUISING	BURNS	OTHER
Mongolian spots	Bullous impetigo	Erythema multiforme
Coagulation disorders	Blistering dactylitis	Popsicle panniculitis
Hemophilia	Staphylococcal scalded skin syndrome	Ehlers-Danlos syndrome
Von Willebrand disease	Erysipelas	Coining
Leukemia	Ecthyma	Cupping
Neuroblastoma	Incontinentia pigmenti	Moxibustion
Idiopathic thrombocytopenic purpura	Contact dermatitis	Maquas
Drug ingestion	Phytophotodermatitis	
Vitamin K deficiency	Epidermolysis bullosa	
Vasculitis	Laxative ingestion	
Henoch-Schönlein purpura	Hair tourniquet	
Hemorrhagic edema of infancy	Localized vulvar pemphigoid	
Erythema nodosum	Linear IgA disease	
Hemangioma	Fixed drug eruption	
Pernio	Car seat or seat belt buckle burn	
	Stevens-Johnson syndrome	
	Lymphangioma circumscriptum	
	Diaper dermatitis	

Mongolian spots can appear as bruises to the untrained eye. They are usually found over the buttocks and lower back, sites that might raise suspicion of abuse, but can also occur anywhere on the body, including the face. Unlike bruises, they do not evolve over days and are nontender. Mongolian spots usually fade in the first 2 or 3 years of life but may persist into school-age years and beyond.

Coagulation disorders can present with frequent bruising and have occasionally been misdiagnosed as abuse. They include hemophilia and von Willebrand disease, as well as acquired diseases such as leukemia, neuroblastoma, idiopathic thrombocytopenic purpura (ITP), drug ingestion, and vitamin K deficiency. Patients with leukemia or ITP often have petechiae in addition to the bruising. In patients with coagulation factor deficiencies, bruises have thick, round, indurated centers. On history, there is a clear mechanism of injury consistent with the configuration but not severity of the bruising (7). A personal and family history of bleeding disorders should be elicited in the setting of suspicious bruising. Laboratory studies including a complete blood count, platelet count, prothrombin, and partial thromboplastin times, and a bleeding time should be ordered. A full coagulation profile may be needed to detect a clotting factor deficiency.

Children with Henoch-Schönlein purpura (HSP) or acute hemorrhagic edema of infancy (AHEI) may present with edema, erythema, and purpura of the face and ears before any other sites become affected (44,45). This picture in an infant should make one highly suspicious of abuse. Buttock and lower extremity involvement is characteristic of HSP and may aid in the diagnosis. Children with HSP may also have a history of a recent infection or associated symptoms such as arthralgia or

abdominal pain. Infants with AHEI will have lesions on the extremities as well as the face and ears. Occasionally lesions can be seen involving the scrotum, another area suspicious for abuse. The patients are febrile although otherwise well appearing. In addition to HSP and AHEI, the purpuric lesions of any of the vasculitides can be confused with abuse (46).

Bullous impetigo may sometimes be confused with cigarette burns, especially when burns become secondarily infected (47). The lesions of impetigo are irregularly shaped, crusted, and superficial, thus healing without scarring. Cigarette burns are well demarcated, deep lesions with a central crateriform appearance and heal with scarring (38). Both can be seen in crops, but cigarette burns tend to have a characteristic location on the face or dorsum of the hands or feet (48).

Phytophotodermatitis misdiagnosed as burns has been reported. The erythema and vesicles, which are commonly streaky or can even occur in the shape of a hand, can resemble a burn (49). Children may present with hyperpigmentation in the shape of a hand, which may be confused with bruising; however, the color variation of a healing bruise is absent and there is history of a preceding inflammatory and/or vesicular eruption. A history of contact with limes or certain garden plants should be sought, although it may not always be elicited.

Accidental laxative ingestion has been reported as a mimicker of abusive burns (50). The laxative in these instances contained senna, but the exact mechanism of erythema and blister formation is unknown. The erythema and bullae noted in these patients were characteristic, because of the overall diamond shape with linear borders that lined up with the diaper edge. In addition, there was sparing of the perianal area and gluteal cleft.

Cultural practices are generally not considered abusive although they can result in bruising and burns. Cao giao or coining, seen in Vietnam and other areas of Southeast Asia, involves rubbing a coin across oiled skin as a remedy for fever. The vigorous stroking results in linear bruising and/or petechiae (51). A similar technique, called spooning or quat sha, is practiced in China.

Cupping is a Latin American and Eastern European folk remedy in which a glass is heated and applied to the skin, creating a vacuum as the air in the glass cools. The suction can create a circular cluster of petechiae or circular bruises, as well as burns (52). In a variation called wet cupping, the skin is abraded first.

Moxibustion is an Asian folk remedy in which the moxa herb, *Artemisia vulgaris*, is burned in an area of the body that needs healing. This can result in full or partial thickness, small, circular burns (53). Maquas are deeper burns inflicted with hot metal spits near an area of illness. This is seen in Arabic, Bedouin, and Russian cultures (48).

WHAT TO DO IF YOU SUSPECT ABUSE

Once a finding suspicious for abuse is discovered, a full cutaneous examination should be performed to look for other signs of abuse, as concurrent injuries are seen in 20% to 33% of abuse victims (3). Clear and thorough documentation of medical findings is vital in the evaluation of abuse. When documenting the history, record the caretaker's explanations of injury verbatim. Obtain as many details of the injury event as possible to help evaluate the plausibility of the explanation. Talk to the child alone and ask what happened, but avoid leading questions and use developmentally appropriate language. Measure and document each finding, including its location, size, shape, and color. All cutaneous injuries should be photographed. The photographs should include the patient's name, the date, and a measurement scale. State in the chart that photos were taken and where they were stored.

A skeletal survey is mandatory in all instances of suspected physical abuse in children younger than 2 years as external injury may be the only sign of an underlying fracture. Skeletal surveys have little value in children older than 5 years because these children infrequently have occult fractures detected by skeletal imaging. The group in between ages 2 and 5 must be handled on an individual basis (54).

In infants, subtle external injuries may be the only clue to serious internal injury (14). Therefore, it may be wise to consult a pediatrician to rule out associated head or abdominal trauma. Signs and symptoms of

abusive head trauma may be subtle and/or nonspecific, and a high index of suspicion should be maintained for infants and young children who have other injuries suspicious for abuse. All children with suspected intracranial injury must undergo a cranial CT or MRI or both (54).

With any instance of suspected abuse, it is crucial to involve professionals with experience in dealing with child maltreatment. Many medical centers now have child protective service teams that include pediatricians with training in child protection, psychologists, social workers, and law enforcement agents. The interdisciplinary approach of such a team allows for a thorough assessment of the child and family.

Medical professionals in all 50 states are mandated by law to report suspicion of abuse to child protection authorities. Definitive proof or certainty of abuse is not required. A verbal report must be made within 24 hours. The verbal report should be followed by a written report. A listing of toll-free child abuse reporting numbers by state can be found at <http://www.acf.dhhs.gov>. Each state has its own system for reporting child abuse. An intake worker screens all reports and determines whether adequate concern exists to initiate an investigation. If the report is accepted for investigation, the case is assigned to an intake worker who assesses the safety of the child and determines the interventions needed to provide adequate protection for the child. Physicians who report in good faith are protected from liability if abuse is not confirmed, but failing to report can result in criminal and/or civil penalties (37). The need to report should always be discussed with the family. The physician should focus the conversation on the well being of the child and not attribute any blame to the caregivers.

CONCLUSION

When abuse is identified early, interventions can be made to aid the child and the family and prevent future abuse. However, if abuse is not recognized, it is often repeated and can escalate to result in more serious injury (2). In most instances of reported abuse, the child is not taken away from the parents. Instead, a variety of support and educational services are provided to the family.

Child maltreatment leaves lasting effects on the physical and psychological well-being of the child. Studies have demonstrated a significant association between physical abuse and a wide range of psychopathology, including aggression, depression, and anxiety (55–58). Abused children are also more likely to engage in alcohol and drug abuse and to have a dysfunctional family life (59,60). The financial burden on society each year runs into the billions (61). Because

many of the physical findings of abuse are cutaneous, it is imperative that dermatologists be aware of these findings and include abuse in their differential when appropriate.

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