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An Update on Physical Abuse of Children

Approximately one in five children evaluated in the emergency department is physically abused. Emergency physicians have a responsibility to consider abuse in the differential of every injured child. Although there is increasing awareness of the emergency physician's role in diagnosing abuse, emergency physicians frequently fail to recognize the more subtle presentations of abuse. This article reviews the identification, evaluation, and management of a child with possible physical abuse.

— Ann M. Dietrich, MD, Editor

Nonaccidental trauma is an important cause of morbidity and mortality in the pediatric population. It is estimated that up to 10% of pediatric injuries seen in the emergency department are caused by abuse, but unfortunately some are missed on initial presentation.¹ Thus, it is critical for emergency physicians to consider nonaccidental trauma in the evaluation of pediatric injuries.

Background

Child abuse has a broad definition that encompasses many different forms of abuse or neglect. Although physical abuse is the most apparent form of abuse, other subcategories of abuse include neglect, emotional abuse, sexual abuse, and child exploitation.² According to the National Child Abuse and Neglect Data System, more than 600,000 children were affected by some form of child abuse or neglect. In 2016, an estimated 1,750 deaths were related to abuse and neglect of a child.

Healthcare professionals play an important role in identifying and reporting child abuse, as nearly one in five children who die from child abuse have received some form of medical care within a month of their death.³ Recognition and identification of child abuse in the emergency department entails maintaining a high index of suspicion while having a non-threatening and non-accusatory approach. Although it can be challenging to differentiate abuse from other accidental or organic causes of injury, early reporting of suspicious injuries to child protective services can be vital in preventing additional, potentially deadly injuries.

Epidemiology

The 2016 Child Maltreatment Report from the Children's Bureau estimates that nearly 3.5 million referrals were made to child protective services because of concern for child maltreatment.⁴ After investigation, more than 675,000 children were deemed to be victims of maltreatment, and an estimated 1,750 child deaths were attributed to child abuse or neglect.⁴

EXECUTIVE SUMMARY

- The most common forms of pediatric abuse include neglect followed by physical abuse. Children younger than 1 year of age are the most susceptible to abuse. Nearly 70% of child abuse fatalities are in children younger than 3 years of age.
- It is estimated that the number of reported cases of child maltreatment represents only 20% of actual cases of abuse.
- Providers should be alert to chronic health problems, repeated accidents or injuries, and missed medical appointments, as these can be red flags for child abuse.
- The TEN-4 (torso, ear, or neck) rule can help clinicians recall which bruising patterns should be evaluated further for abuse; bruising on the torso, ear, or neck or bruising in any area in children younger than 4 months of age is concerning for abuse.
- When differentiating between an adult bite vs. a child bite, the typical distance between the mandibular canines in adults is usually > 3.0 cm, while in children the space tends to be smaller, at approximately 2.5 cm.
- Indications for abdominal computed tomography scan include gross hematuria, microscopic hematuria ≥ 50 red blood cells per high power field (RBCs/HPF), elevated transaminases (aspartate aminotransferase [AST] > 200 iu/L, alanine aminotransferase [ALT] > 125 iu/L), or concerning historical or physical signs.
- In child abuse, there is an increased occurrence of pancreatic injuries and duodenal hematomas that are difficult to diagnose at times by imaging. Providers should have a high index of suspicion for these injuries with a concerning abdominal exam, even in light of normal imaging.
- Certain fractures have a high association with nonaccidental trauma and include rib fractures, metaphyseal (corner or bucket) fractures, acromion and spinous process fractures, sternal fractures, and vertebral body fractures or subluxations.
- Diffuse, multilayered, retinal hemorrhages occurred in 85% of abusive head trauma. Isolated retinal hemorrhage without intracranial findings is uncommon.

The most common form of child maltreatment was in the form of neglect at 74.8%, followed by physical abuse at 18.2%. Children younger than 1 year of age were most susceptible to abuse, at 24.8 per 1,000 children. Nearly 70% of child fatalities were in children younger than 3 years of age. Children of American-Indian and Alaska Native populations were at greatest risk. In children younger than 1 year of age, caregiver alcohol or drug abuse increased the rate of child maltreatment. Boys were more susceptible to fatal injuries than girls.

Based on a retrospective, cross-sectional analysis of child abuse fatalities in U.S. children 0 to 4 years of age from 1999 to 2014, poverty was closely associated with increased fatalities.⁵ More than three-quarters of child fatalities involved at least one parent, with nearly 85% of the perpetrators being between the ages of 18 and 44 years and more than half were women. Teachers, legal and law enforcement personnel, and social services workers represent the majority of individuals who made reports of child maltreatment. Despite these data, it is estimated that the number of reported cases of child maltreatment represents only 20% of actual cases of abuse.⁶

Evaluation for Abuse: History

A careful and well-documented history of the presenting complaint is the most important initial component for a child with suspected child abuse. A complete history should be obtained from parents or other caregivers regarding the details of the injury in a non-accusatory manner. It is important to allow the caretaker to give a complete story. Interruptions should be minimized and additional questions can be asked at the end. Frequent interruptions or questioning can cause the caretaker to alter his or her story or leave out important details regarding the event. When an adolescent presents with concerns for child abuse, caretakers should be asked to step out of the room so a history can be obtained from the patient's perspective.

In addition, a review of the general medical, social, and developmental history can help the provider distinguish between accidental trauma and nonaccidental trauma. Providers should be alert to chronic health problems, repeated accidents or injuries, and missed medical appointments, since these can be red flags for child abuse. (See Table 1.) Family history of bleeding, bone, metabolic, or genetic disorders can make an

organic cause of the injury more likely. A prenatal history should be obtained, as unwanted or unplanned pregnancies, limited prenatal care, postnatal complications, and postpartum depression can increase the risk of child abuse.

The diagnosis of abuse should be considered when there are injuries in different stages of healing, or injuries involving multiple body parts, or when the pattern of injury is pathognomonic for abuse. Other concerning factors for abuse include a history that does not match the injury pattern or developmental stage of the child, or if there has been a delay in seeking medical care. Finally, the parent likely will have been interviewed by various different medical staff (i.e., triage nurse, physician, and social worker). It can be helpful to corroborate the story between different staff members to ensure that the history and time line remain consistent. Different accounts of the event also can be a red flag for abuse. Poverty, parental substance abuse, and mental health issues are three of the most common risk factors for child maltreatment and abuse.

Diagnostic Testing

A medical etiology of the injury should be considered in the

Table 1. Risk Factors for Child Abuse²

| | |
|----------------------------|--|
| Child risk factors | <ul style="list-style-type: none"> • Prematurity • Young age (< 4 years) • Multiple gestation births • Chronic disability |
| Caregiver risk factors | <ul style="list-style-type: none"> • Substance abuse • Mental health concerns • Domestic violence • Adolescent parents |
| Family/social risk factors | <ul style="list-style-type: none"> • Single-parent families or multiple transient caregivers • Unemployment • History of involvement with child welfare services • Isolation |

Table 2. Features of Bruises Suggestive of Abuse

- The pattern of injuries corresponds to infliction with an instrument not found in play or the child’s usual environment, such as linear bruises and petechiae on the buttocks and gluteal cleft from hitting, spanking, whipping, or paddling
- Linear bruising and/or petechiae of the pinna from blows to the skull (“tin ear syndrome” is comprised of bruising to the pinna, retinal bleeding, and acute traumatic head injury)
- Hand prints or oval marks on cheeks, neck, upper arms, trunk, or buttocks (from being punched, slapped, grabbed, shaken, or pinched)
- Belt marks (leaving long bands of ecchymosis, sometimes with a u-shape at the end or puncture wounds from the buckle)
- Loop marks from beating with a rope, wire, or electric cord (electric cords leave a characteristic “double-track mark”)
- Ligature marks or circumferential rope burns seen on the neck, wrists, or ankles, and gag marks at corners of the mouth
- Any history of injury inconsistent with the child’s level of development or with the category and extent of the injury should raise suspicion for abusive trauma

differential diagnoses of suspected physical abuse. Obtaining blood work or imaging studies can help differentiate between injuries caused by abuse and an underlying medical cause.

The diagnostic evaluation for suspected physical abuse, especially fractures, includes a skeletal survey. In instances in which the suspicion for abuse is high and the initial skeletal survey is negative, a follow-up skeletal survey should be obtained in two

weeks to look for fractures that are starting to heal. A whole body X-ray, also known as a “baby gram,” is not sufficient, and dedicated views of the axial and appendicular skeleton are necessary. Laboratory testing that can help identify an underlying organic cause includes serum calcium, phosphorous, alkaline phosphatase, parathyroid, and 25-hydroxyvitamin D levels. DNA analysis for osteogenesis imperfecta (OI) can be helpful for

children with multiple or recurrent fractures.²

Suspicious bruises in children should be evaluated for hematology disorders with a complete blood count, coagulation profile, von Willebrand activity levels, and factor VIII and IX levels. In addition, a skeletal survey should be obtained in children who are nonambulatory or in toddlers with bruising that does not match the mechanism of injury. A head computed tomography (CT) should be considered in infants with suspicious bruising. Consultation with a hematologist in cases of family history or clinical history concerning for a bleeding disorder is appropriate.²

Abdominal trauma should be considered and evaluated in young children, as it can be useful in identifying occult injury and can minimize unnecessary cross-sectional imaging and radiation exposure. Abnormal liver enzymes and pancreatic enzymes can raise suspicion for an occult abdominal injury. An abdominal CT with IV contrast is the optimal imaging modality for suspected abdominal trauma.²

Head trauma evaluation includes a CT scan of the head in the acute evaluation. An MRI of the brain may provide better dating of injuries compared to a CT scan and is more sensitive for subtle injuries. In addition, laboratory workup for an underlying bleeding disorder should be obtained similar to the workup for bruising.²

Types of Injuries

Bruising

Bruises account for nearly 40% of all abuse-related injuries and are the most apparent injury that occurs from physical abuse. (See Table 2.) Unfortunately, they often are missed during the initial presentation in almost half of all fatal or nearly fatal abuse-related deaths. Exposing the child and performing a full body physical exam to look for bruise marks that are in different stages of healing is important, as this can be characteristic of nonaccidental trauma. However, it is not possible to classify when an injury occurred based on the color of a bruise because of wide variability in

bruise development. Additional clues like size, location, and mechanism of injury also can help providers distinguish between accidental and abuse-related trauma.⁷ Bruising does not occur commonly in children younger than 6 months of age since they are not mobile. As infants learn to crawl, cruise, and walk, usually between 6 and 12 months of age, bruising can be common in areas with a bony prominence such as the elbows, knees, pretibial area, and forehead. Bruises on specific body parts, generally including the axial skeleton like the back, neck, and torso, should raise concern for abuse. In addition, bruising on the cheeks, eyes, and genitalia also are areas that are less likely to result from an accidental injury.⁷ The TEN-4 (torso, ear, or neck) rule can help clinicians recall which bruising patterns should be evaluated further for abuse. Based on this mnemonic, bruising on the torso, ear, or neck or bruising in any area in children younger than 4 months of age is concerning for abuse.⁷ (See Table 3.) Patterned bruises, such as belts, hand prints, and loop marks, are highly suspicious for abusive injury.

The differential diagnosis for bruising can be broad and confounded by underlying medical conditions. Laboratory studies can help identify non-abuse causes, especially an underlying malignancy or coagulopathy. A common diagnosis, especially in African-American, Hispanic, and Asian children, is dermal melanocytosis, which can appear as gray-bluish areas over the sacrum, back, and sometimes limbs; it usually is present at birth.⁸ Documentation of this condition is extremely important since it will mimic bruising very closely. Hemangiomas can appear in infants and will appear reddish to bluish in color, but tend to have a raised appearance. These will expand rapidly during the first year of life and then regress. Phytophotodermatitis from sun and citric acid exposure can mimic bruising, so taking an appropriate history can easily help differentiate this from abuse.⁹ Malignancies, such as leukemia, and bleeding disorders, such as vitamin K deficiency, hemophilia, and von Willebrand disease, can result

Table 3. Red Flags for Child Physical Abuse on Examination

Bruises

- Any bruising in infants < 4 months of age or non-mobile children
- Bruises on the torso, ear, neck, or buttocks
- Patterned bruising
- Bruises in different stages of healing

Burns

- Scalds due to immersion that demonstrate a line of demarcation often involving the lower extremities and/or perineum
- Sparing of soles of feet
- Burns that mirror the shape of objects (e.g., clothing iron, curling irons, or the metal tops of cigarette lighters, cigarette burn)
- Full-thickness burns unlikely to have been accidental

Fractures

- Metaphyseal corner fractures
- Rib fractures
- Fractures of the sternum, scapula, or spinous processes
- Long bone fracture in a nonambulatory infant
- Multiple fractures in various stages of healing
- Bilateral fractures
- Vertebral body fractures and subluxations
- Complex skull fracture

Serious injury without explanation*

- Subdural hematoma or retinal hemorrhage without history of significant trauma
- Significant abdominal injury (bowel hematoma/perforation)

Classic red flags for abusive trauma in the history

- Changing details with the caretaker's repetition of the story
- Details inconsistent with findings on physical exam
- Findings of additional injuries or more severe injuries than described
- Injuries described as self-inflicted or inflicted by another child
- Injuries not compatible with developmental stage of the child
- Delay in seeking care for injuries
- Seeking care at different healthcare facilities with each presentation

Classic red flags for abusive trauma on physical exam

- Multiple injuries and multiple types of injuries at different stages of healing
- Multiplanar or unusual locations of injuries (neck, ears, perineal area, abdomen, upper arms)
- Poor hygiene or poor caretaker-child interaction
- Pathognomonic injuries: subdural hematoma, posterior rib fractures, spiral fractures (nonambulatory children), metaphyseal fracture (bucket handle), scapular and spinous process fractures, sternal fractures
- Patterned injuries: hand imprint, cigarette burns, grill marks, or loop marks

* Any major traumatic injury without a plausible explanation is concerning for physical child abuse.

Figure 1. Humerus Fracture



Source: Ann M. Dietrich, MD

in coagulopathies and can cause easy bruising that may be mistaken for physical abuse. Finally, traditional practices, such as cupping, coining, or applying incense to the skin, should be considered in the appropriate clinical scenario.

Bite Marks

Physical and sexual abuse should be considered when bite marks are present on a child. They will appear as an ovoid or elliptical bruise or abrasion and may have a central area of ecchymoses from closing of the teeth or by suctioning and tongue thrusting.⁸ Although bite marks from an adult are concerning for abuse, other children or animals can cause bite marks that will result in different injury patterns. Human bites usually are superficial, while bites from animals tend to be deeper. It is more difficult to see individual tooth marks from a human bite, whereas animal bites can have more distinguishable teeth markings. If tooth markings are seen from a human bite, the spacing between teeth marks can help differentiate between an adult and a child bite. The typical distance between the mandibular canines in adults is usually greater than 3.0 cm, while in children the space tends to be smaller at approximately 2.5 cm. Given the small variability in distance between canine teeth in adults and children, forensic dentistry can be helpful in evaluating the pattern of the bite injury in more detail.

Abdominal Injuries

Suspected nonaccidental trauma must include the possibility of abdominal trauma in the presenting child. Unique features of the pediatric abdomen make children more vulnerable to injury. The musculature of the pediatric abdomen is thinner than an adult's abdomen, so underlying organs have less overall protection. Pediatric solid organs are larger overall when compared to the total abdominal space. This makes a greater area of exposed organ surface vulnerable to trauma. The intestines have different attachments developmentally, allowing for more direct impact with trauma. Blunt abdominal trauma, deceleration, or compression may result in injuries to the spleen, liver, kidneys, pancreas, or intestines.

Often, these injuries are not obvious from external examination of the skin alone and require a thorough abdominal exam. A red flag for abuse is no historical explanation for abdominal trauma in a child younger than 5 years of age. Kicking, kneeling, or making direct blows with hands or objects to the abdomen can cause contusion, laceration, or perforation to hollow or solid organs.

Evaluation of the suspected nonaccidental trauma pediatric patient for abdominal trauma includes a laboratory and imaging workup. A complete blood count, comprehensive metabolic panel, lipase, and urinalysis are key components. (See Table 3.) Evaluation for anemia, elevated

transaminases, pancreatic enzymes, and hematuria are important lab abnormalities in the evaluation and increase suspicion for internal injury.

CT of the abdomen and pelvis using IV contrast is the best acute imaging for consideration of blunt abdominal trauma in child abuse. Indications for CT include gross hematuria, microscopic hematuria ≥ 50 red blood cells per high power field (RBCs/HPF), elevated transaminases (aspartate aminotransferase [AST] > 200 iu/L, alanine aminotransferase [ALT] > 125 iu/L), or concerning historical or physical signs.

In child abuse, there is an increased occurrence of pancreatic injuries and duodenal hematomas that are difficult to diagnose at times by imaging. Providers should have a high index of suspicion for these injuries with a concerning abdominal exam even in light of normal imaging.

Fractures

Although accidental injuries account for the majority of fractures in children, physical abuse often can result in skeletal injury, especially in infants. Studies have estimated that 20% of children present with an abuse-related fracture as a sentinel injury.¹⁰ (See Figure 1.) A lack of witnesses, an inability to provide mechanism of injury, or a mechanism that does not fit with the child's developmental level should raise concern for nonaccidental trauma. When fractures are suspected, associated findings of "grab marks" resembling an adult handprint may suggest forceful restraint caused the fracture. However, the absence of these marks does not exclude an underlying fracture, and the majority of abusive factors will not have any immediate or delayed bruising.

Certain fractures have a high association with nonaccidental trauma and include rib fractures, metaphyseal (corner or bucket) fractures, acromion and spinous process fractures, sternal fractures, and vertebral body fractures or subluxations (without appropriate trauma history). (See Table 3.) Some fractures may not be clinically detectable, and a radiographic skeletal survey should be obtained when physical

abuse is suspected. The American Academy of Pediatrics has guidelines for when a skeletal survey is indicated.² (See Table 4.) The components of a skeletal survey include both the axial and appendicular skeleton. The appendicular skeletal images include views of the arms, forearms, hands, thighs, legs, and feet. The axial skeleton includes images of the thorax to include the thoracic spine and ribs, abdomen, lumbosacral spine, bony pelvis, cervical spine, and the skull.

Other diagnoses to consider in a child presenting with suspicious skeletal injuries include diseases that affect collagen and bone mineralization, which can make a child prone to fractures. These can include a history of congenital syphilis, osteomalacia or rickets, and OI. Bone health laboratory testing, including calcium, phosphorous, alkaline phosphatase, 25-hydroxyvitamin D, and parathyroid hormone levels, can aid in this evaluation. OI easily can be mistaken for nonaccidental trauma; however, certain physical exam findings, such as blue sclera, abnormal dentition, and short stature, can provide clues to this diagnosis. In addition, subtle radiographic findings can help distinguish physical abuse from OI.²

Central Nervous System Trauma

Central nervous system trauma occurs quite frequently in cases of nonaccidental trauma. Head injuries are most common and have the highest risk for leading to death. In one case review, about 60% of nonaccidental trauma cases were due to head injury and involved a fivefold risk of mortality.¹¹

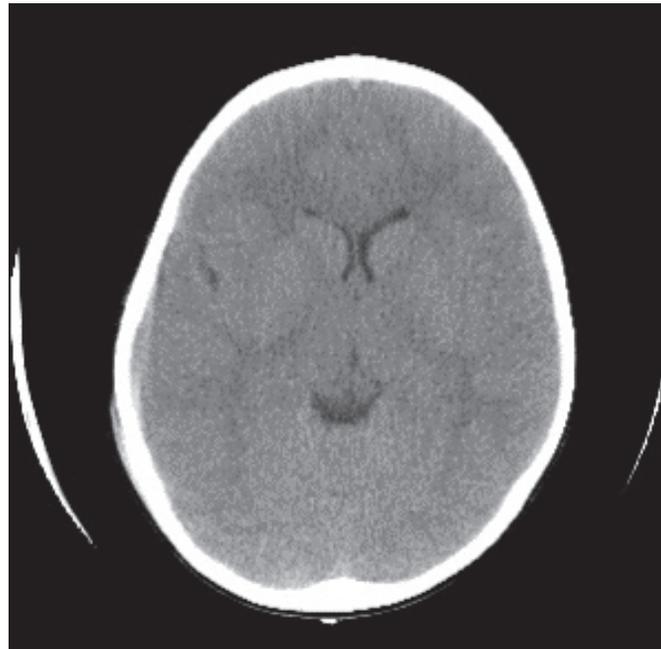
Abusive head trauma, formerly referred to as “shaken baby syndrome,” and its secondary complications should be investigated promptly. The challenging part is differentiating between accidental trauma and abusive head trauma. About one-third of abusive head trauma cases are missed on initial presentation.¹² Common misdiagnoses include birth trauma, viral gastroenteritis, sepsis, and accidental head injury.¹³ In one study, benign enlargement of the subarachnoid spaces (BESS) was seen in about 39% of children who were found to have a subdural

Table 4. American Academy of Pediatrics Guidelines for Obtaining a Skeletal Survey

- All children < 2 years old with highly specific abusive injuries
- All children < 2 years with suspicious injuries
 - Bruising in nonambulatory infant
 - Oral injuries in nonambulatory infants
 - Inconsistent history
- Infants and children with unexplained intracranial injuries
- Siblings of abused child
- Unexplained sudden death in an infant (in consultation with medical examiner)

Source: Wood JN, Fakeye O, Feudtner C, et al. Development of guidelines for skeletal survey in young children with fractures. *Pediatrics* 2014;134. Available at: <https://pediatrics.aappublications.org/content/134/1/45>. Accessed June 10, 2019.

Figure 2. Subdural Hematoma



Source: Ann M. Dietrich, MD

hematoma. However, these children did not have other suspicious findings and had very mild symptoms.¹⁴ Symptoms may be subtle and can range from very mild (irritability, vomiting) to seizures and altered mental status. Children often present without any history of trauma, so one must have a high clinical suspicion plus evidence of trauma, which may not be isolated only to the skull. Red flags in the history include

inconsistent history among caregivers, trauma that is inconsistent with the patient’s developmental stage, nonspecific symptoms (lethargy, poor feeding, difficulty breathing), a past medical history that includes failure to thrive, or medical visits for bruising or trauma.^{12,15} Findings of an isolated skull fracture, epidural hematoma, and scalp swelling were predicted to be more associated with accidental head injury.¹³

Table 5. Laboratory and Imaging Considerations

Routine laboratory data and imaging

- Complete blood count with differential (infection, bruising, bleeding, inflammation)
- C-reactive protein (infection, inflammation)
- Erythrocyte sedimentation rate (infection, inflammation, rheumatologic disorders)
- Coagulation panel (bruising, bleeding)
- Lumbar puncture for cerebrospinal fluid studies (seizures, altered mental status, infection; consider head CT first)
- Complete metabolic panel (seizures, dehydration)
- Tests for abdominal injury: liver function tests, amylase, lipase, stool occult blood, urinalysis/urine dip for occult blood
- Urine (and serum) toxicology panels (seizures, altered mental status)

Imaging

- Skeletal survey (for children < age 2), 20 views
- AP views of humeri, forearms, hands, femurs, lower legs, and feet; thorax; pelvis; lateral view axial skeleton (infants); and AP and lateral views of skull (usually done post admission)
- Radionuclide bone scanning for identification of new rib fractures and occult fractures, as indicated (usually by recommendation of radiologist or child abuse consultant)
- Head CT for any child with suspected intracranial injury and/or intracranial pressure signs (should be completed in ED)
- If positive or if suspect subacute injury, brain MRI (further assessing and dating the injury; may be recommended by radiologist or child abuse consultant)
- Thorax/abdomen/pelvic FAST, US, CT, or MRI for further injury evaluation as indicated: consider with abdominal bruising/injury and/or AST/ALT > 80. Should be completed in ED
- Fundoscopic exam by ophthalmologist if concern for traumatic brain injury on imaging or exam (with photodocumentation) (usually done post admission)

Source: Baz B, Wang NE. Physical abuse of children: Identification, evaluation, and management. *Pediatric Emergency Medicine Reports* 2012;17:77-92.

If a provider suspects abusive head trauma, CT or MRI should be obtained. Subdural hemorrhage is the most common neuroimaging finding. (See Figure 2.) Diffuse, multi-layered retinal hemorrhages occurred in 85% of abusive head trauma. Isolated retinal hemorrhage without intracranial findings was uncommon.¹⁶ If findings on neuroimaging prompt further evaluation, then skeletal survey, laboratory evaluation, and ophthalmological evaluation should be followed. (See Table 5.)

Timely diagnosis is of utmost concern, as children are more susceptible to secondary brain injury. Studies have shown that survivors of abusive head trauma are at future risk for epilepsy, motor deficits, visual deficits, sleep disorders, language abnormalities, attention deficits, and behavioral abnormalities.¹⁷

Burns

Burns secondary to intentional abuse account for about 5.8% to 8.8% of cases annually.¹⁸ In one study reviewing pediatric burn admissions, researchers estimated that about 5% of cases were due to abuse, with scalding being the most common.¹⁸ Burns can be due to multiple sources such as liquids (hot water), chemicals, contact with hot objects, flames, or electricity. Accidental burns can occur, and those are usually shallow and without sharp demarcation because of the withdrawal reflex. Specific details must be obtained and can be helpful in differentiating accidental from nonaccidental incidents. For example, if a splash/spill burn occurred, then the location of initial contact should be the most prominent. As liquid falls downward, the pattern of injury should follow.

This also will be altered depending on whether the child was wearing clothing, which is another important detail to obtain. Immersion burns lack splash marks since the child would have been held down and may have soft tissue contusions to support this evidence. Instinctively, a child will flex, so body creases will be spared from the burns. In one study, investigators found the location of a specific burn site was not associated with a greater likelihood of abuse.¹⁹ However, the lower extremities, perineum/buttocks, and trunk were commonly involved areas. Scalding injuries were predominant in nonaccidental trauma, with contact burns second to those. Bilateral and symmetric patterns also increased the likelihood of abuse. Sharply outlined burns often are associated with cigarette burns or objects such as curling

Table 6. Documentation of Suspected Abuse

The medical record may be admitted as evidence in court. Accurate, detailed, legible records are essential. The record should include:

- Date and time of injury
- When the child was last well
- When the injury was first noted
- Where the injury occurred
- Who was present and witnessed the injury
- What led up to the injury
- How the child and caretaker responded to the injury
- Delay in time before seeking care for the injury
- Physical exam findings, evidence collection
- Photographs of all findings with child's name, record number, ruler, color scale (often done by law enforcement)
- Diagrams/detailed drawings in chart if multiple injuries
- Recent or fresh bite marks can be swabbed for saliva with a sterile cotton swab moistened in sterile saline, dried, and packaged in an envelope from an evidence kit for DNA processing
- When there is a clear dental imprint, casts of the bite marks can be matched with an abuser by a forensic dentist or pathologist

Source: Baz B, Wang NE. Physical abuse of children: Identification, evaluation, and management. *Pediatric Emergency Medicine Reports* 2012;17:77-92.

irons or grills. (See Table 3.) The likelihood of abuse was higher in those children with other associated findings, such as other cutaneous lesions or fractures.¹⁹

Conditions to consider other than intentional burns include local skin infection, staphylococcal scalded skin syndrome, and cultural practices such as cupping. Based on retrospective data, a high clinical suspicion should be prompted when the following factors are present with burns: inadequate explanation, the burning agent is hot water, immersion mechanism, bilateral pattern, total body surface area burn $\geq 10\%$, and full thickness depth.¹⁹

Medical Child Abuse

Medical child abuse (also known as Munchausen syndrome by proxy or factitious disorder imposed on another) is a form of child abuse due to fabricated ailments that are caused by the primary caregiver. This condition will lead to physical harm due to unnecessary testing prompted by the caregiver. There is an association between children who have complex medical needs

and medical child abuse. Caregivers often are female and in the medical field. Red flags that should prompt suspicion for medical child abuse include multiple visits, objective data inconsistent with the history, request for invasive testing, caregiver is resistant to obtaining records, and unexplained symptoms only witnessed by the caregiver.²⁰ There are little data of incidence or prevalence. Harm also can be elicited by forced ingestion or starvation. Many forced ingestions include substances commonly found in the home, such as water, salt, prescribed medications, or over-the-counter medications. Ingestion may occur because of neglect, which still is a cause for concern. Forced water ingestion may lead to hyponatremic seizures, and unexplained hypernatremia can be seen with forced salt ingestion. Other medications to note include warfarin to mimic a bleeding disorder or insulin to cause hypoglycemia and associated altered mental status. Also be aware of the possibility of bacteria being introduced to cause sepsis. Although less common, starvation can be seen. One case

identified obesity in the caretaker as an independent risk factor.²¹

Medical-Legal Consideration

If child abuse is suspected, then a child protective services report is mandated, even if it is a suspicion and not a certainty. All state laws offer some form of protection for good-faith reporting.² All cases of suspected abuse should be documented in a careful, thoughtful, and complete manner. (See Table 6.) Although difficult, it is in the best interest of the investigation to involve parents from the beginning, which means letting them know that a report has been filed. Early law enforcement involvement also is important. The Health Insurance Portability and Accountability Act of 1996 allows for disclosure of protected health information without parental permission when physicians have made a child protective services report.² It is helpful to involve social workers because they can help explain the process and the next steps to the family and child. Some hospitals have a team

Table 7. What To Do When Considering a Diagnosis of Abuse

Call social work: They can assist with the interview of the family, and discussion with child protective services.

Call child protective services: They will take a report and decide whether they will pursue an investigation. Often, child protective services is involved in assisting with disposition of the child if not admitted (they will make a safety plan) or when the child goes home from the hospital.

Call child abuse consultant: They are key in suggesting studies for workup as well as discussing appropriate disposition. Regional child abuse centers often have a consultant on call if there is not one available in your system.

General rule for disposition: If there is any question of the child's safety at home (e.g., unexplained injury, uncertain perpetrator), and/or further workup is required (such as a skeletal survey, etc.), these children should be admitted to the hospital for observation and protection until the workup can be completed and safe disposition can be decided between the admitting provider, the child abuse consultant, social services, and child protective services.

Inform the family diplomatically that it is routine to involve social services, child protective services, and a child abuse consultant in cases of unexplained injury.

of medical professionals that deals specifically with cases of child abuse, and this input is valuable. (See Table 7.) A child may need to be admitted, whether it is for his or her own safety or for further evaluation by subspecialists.

Once a report has been made, then child protective services and law enforcement can begin the investigation. Detailed documentation is of utmost importance, and pictures can be placed within documentation as well. (See Table 6.)

Conclusion

Physicians are mandated to report child abuse, and always must keep it on the differential, especially when red flags are present. These include injury to non-mobile infants, patterned injuries, multiple injuries in different stages of healing, and significant injuries that are not explained. Early identification of abuse can be lifesaving, and providers should take precautionary steps, using available resources and providing detailed documentation.

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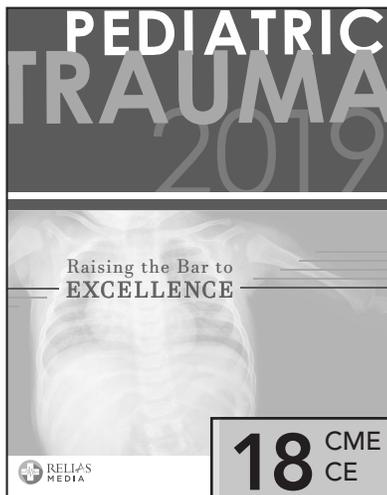
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CME/CE Questions

1. A 6-week-old boy presents to the emergency department with his parents for an episode of unresponsiveness and turning blue. The parents report they performed CPR while waiting for EMS to arrive. On physical exam, the infant is arousable only to painful stimuli and there are multiple bruises on the trunk. Which of the findings should raise concern for suspected child abuse?
 - a. A rash on the forehead
 - b. Blue-gray spot on the lower back
 - c. Blue sclera
 - d. Posterior rib fracture
2. The majority of child maltreatment occurs in what form?
 - a. Neglect
 - b. Physical abuse
 - c. Psychological abuse
 - d. Sexual abuse
3. At which of the following ages would bruising on the tibia be likely?
 - a. 2 months
 - b. 6 months
 - c. 9 months
 - d. 12 months
4. Which of the following characteristics can help differentiate a human bite mark from that of an animal?
 - a. Depth of bite mark
 - b. Degree of central ecchymosis
 - c. DNA testing of saliva from the bite mark
 - d. Wound culture from the bite mark
5. A 5-year-old child is brought to the pediatrician's office for a routine well-child check. During the physical exam, the provider notes a palm-shaped area of redness on the child's upper back. The mom reports that she noticed the rash on her daughter's back after they had spent an entire day outside selling homemade lemonade. What is the most likely cause of the redness on the child's back?
 - a. Coagulopathy
 - b. Intentional burn injury
 - c. Physical abuse
 - d. Sunburn
6. What type of nonaccidental trauma has the highest mortality rate?
 - a. Head trauma
 - b. Full thickness burns
 - c. Multiple long bone fractures
 - d. Electrolyte derangements secondary to starvation
7. A 2-month-old female presents to your emergency department and is subsequently found to have a left femur fracture. You have a high suspicion for child abuse. Besides ensuring the safety of the infant, what is legally required of you as a physician?
 - a. Admit the patient for operative intervention
 - b. Discuss your concerns with the family

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- c. Obtain a social work consult
 - d. Contact child protective services
8. An 18-month-old male presents to the emergency department via EMS with a chief complaint of burn injury. Per the family, the patient fell into the bathtub with hot water and when they noticed, they quickly took him out. On physical examination, the burns are mostly localized to the buttock, perineum, and bilateral upper thighs. The torso and soles of feet appear to be spared. What is your next step in management?
- a. Dress the burn wounds and send the patient home with follow-up.
 - b. Admit the patient to a pediatric burn center to ensure his safety, as you are concerned for nonaccidental trauma.
 - c. Discuss your concerns with the family and discharge home with primary care follow-up.
 - d. Treat the child with antibiotics.
9. You are admitting a 4-month-old to the pediatric intensive care unit with bilateral subdural hemorrhages, which are suspicious for nonaccidental trauma. What other physical exam finding could solidify your suspicion?
- a. Retinal hemorrhages
 - b. Depressed anterior fontanelle
 - c. Dry mucus membranes
 - d. Candida dermatitis

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- formulate a differential diagnosis and perform necessary diagnostic tests;
- apply up-to-date therapeutic techniques to address conditions discussed in the publication;
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