Physical child abuse: Recognition

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INTRODUCTION

This topic will discuss the initial recognition of physical child abuse. The clinical findings, diagnosis, and management of physical child abuse, sexual abuse, and child neglect are discussed separately:

- (See "Physical child abuse: Diagnostic evaluation and management" and "Child abuse: Evaluation and diagnosis of abusive head trauma in infants and children".)

- (See "Evaluation of sexual abuse in children and adolescents" and "Management and sequelae of sexual abuse in children and adolescents".)

- (See "Child neglect: Evaluation and management".)

DEFINITION

Physical child abuse may be broadly defined as injury inflicted upon a child by a parent or caretaker. Specific definitions can vary widely among countries, as well as among different ethnic and religious groups [1,2].

EPIDEMIOLOGY

In the United States, physical abuse accounts for approximately 10 percent of the over 650,000 annual cases of child maltreatment reported and validated by state child protection services [3].

In the United States and resource-rich European countries, the estimated prevalence of physical abuse at any time during childhood ranges from 5 to 16 percent, with as few as 5 percent of all episodes of physical abuse being reported to child protection agencies [4,5]. The impact of the 2019 to 2022 severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic on rates of child abuse is unclear. Data from early in the pandemic is mixed, with papers showing increases, decreases, and no change in emergency department visits and hospitalizations for abuse [6-9]. Studies looking at official child maltreatment reports, which tend to be dominated by neglect reports, showed a decrease in recognized child maltreatment [10]. Changes in actual and recognized rates of abuse likely reflect a mix of protective and risk factors including the many stressors resulting from the pandemic, government assistance designed to counter those stresses, an increased number adults in the home, the sequestering of children away from locations where abuse is commonly identified, and decrements in the functional capacity of child protection service agencies.

Among children younger than 15 years, the World Health Organization estimates that child abuse or neglect accounts for 13 percent of the 1.2 million annual deaths due to injury worldwide [4]. In the United States, up to 2500 children die of inflicted injuries annually with children under 1 year of age affected disproportionately [4]. The incidence of fatal child abuse may be underreported. As an example, in an observational study of death certificates reviewed by a multidisciplinary child fatality review team, of the children who died as a result of abuse or maltreatment, only half of the certificates included codes that were consistent with child abuse [11].

Since the mid-1970s there appears to be no significant change in the frequency of child maltreatment syndrome or assault, physical abuse deaths, and admissions for injuries related to child abuse in the United States, Canada, Sweden, Australia, New Zealand, and the United Kingdom despite increased child protection activities [12,13]. While recent government statistics indicate a decrease in the incidence of child abuse in the United States [3,14], an increase in both serious injury and death from child abuse has been documented, suggesting the possibility that decreases are due to changing definitions and administrative practices rather than improved recognition and prevention [15].

RISK FACTORS

Certain factors place a child at higher risk for physical child abuse based upon observational studies [2]. While these factors clearly contribute to the occurrence of violent acts, and are crucial targets for prevention programs, they must not become the sole foundation for suspecting, evaluating, or diagnosing abuse:

- **Child characteristics:**

  - Speech and language disorders, learning disabilities, conduct disorders, and non-conduct psychiatric disease [16,17] (see "Promoting safety in children with disabilities", section on 'Maltreatment or neglect')
  - Failure to thrive
  - Congenital anomalies, intellectual disability (mental retardation) or other handicaps, or chronic or recurrent illnesses [18]
  - Attention deficit disorder with hyperactivity children [19,20]
  - Prematurity and low-birth weight, although the data are conflicting [21-25]
  - Unplanned pregnancy
  - Unwanted child

- **Environment**:

  - Unrelated adolescent or adult male caregiver in the household [26]
  - Domestic or intimate partner violence [27]
  - Animal cruelty [28]
  - Acute or chronic family stressors (eg, divorce or interpersonal conflict, illness, or job loss)
  - Living in poverty
  - Social isolation (distant or absent extended family)

- **Caregiver features**:

  - Young or single parents
  - Parents with lower levels of education
  - Unrealistic expectations for child; poor knowledge of child development
  - Negative perception of normal child behaviors [29]
  - Caregiver was abused or neglected as a child, leading to abuse or neglect of their own children as a learned behavior
  - Substance or alcohol abuse
  - Poorly controlled psychiatric illness (eg, psychosis, depression, impulse disorder) [30]

APPROACH

Abused children returned to an abusive environment without intervention are highly likely to be maltreated again and are at an increased risk for death [31-36]. Repeat maltreatment rates are estimated at about 33 percent. Clinicians may miss many physical abuse injuries at first

presentation [37-39]. For example, one in four children admitted with abusive head trauma had one or more opportunities for milder child maltreatment to be identified at earlier medical evaluations [40]. Observational studies show that clinicians demonstrate significant detection biases based upon the patient's ethnicity or socioeconomic status [35,36,41-47]. Passing from a general state of awareness to concern for a particular patient often requires recognition of a "red flag" for abuse.

In order to avoid missing such a red flag, the following approach is recommended:

- Immediate threats to the child must first be stabilized without concern for issues of child abuse.

- If a nonspecific condition; such as altered consciousness, vomiting, or pain does not have a clear medical explanation, trauma must be considered in the differential and a search for evidence of trauma incorporated into the assessment plan.

- When trauma is an active component of the differential diagnosis, a thorough history should probe for the occurrence and details of specific trauma events over a time period that accounts for the duration of symptoms and any reasonable symptom-free interval. If there are multiple caretakers, it is best that each caretaker be interviewed separately, so that their histories can be compared.

- When trauma is an active component of the differential diagnosis, a thorough physical examination should view and palpate all accessible surfaces of the body. Special attention should be given to the mouth, pinnae of the ears, the scalp, the buttocks and ano-genital region, and body folds such as the neck. (See 'Oral injuries' below and 'Inflicted bruises' below.)

- When injury is identified by the initial assessment, the clinician should assess three issues:

  - Does the injury possess a shape or pattern that indicates an abusive mechanism (loop-of-cord marks, slap marks, bites, immersion burns (figure 1 and figure 2))? (See 'Oral injuries' below and 'Intentional burns' below and 'Inflicted bruises' below.)

  - Does the injury have an elevated statistical association with abuse such as subdural hematoma, rib fractures, femur fracture in non-walking children, pancreatic and proximal small bowel injury, immersion burn (table 1)? (See 'Fractures' below and 'Serious injury without explanation' below.)

  - Does the given trauma history match the nature of the injury, the time course of the injury symptoms and healing, the history of other caretakers, and the child's

developmental capacities (table 2)? (See 'Red flag history' below.)

- Assess the social history. This should include family stressors, drug use, the occurrence of domestic violence, and prior involvement with a children's protective services agency. Often a social work consult is the best way to achieve this goal. (See 'Additional factors' below.)

- If evaluation and social history lead to abuse concerns, initiate a full child abuse evaluation. (See "Physical child abuse: Diagnostic evaluation and management".)

- Have a low threshold for consulting with a multidisciplinary child abuse team that includes child abuse specialist when considering physical child abuse as an etiology for specific findings. Some institutions without these resources have successfully developed relationships with referral centers and algorithms prompting consultation [48,49].

- Report all suspicions for physical child abuse that persist after the initial assessment to the appropriate governmental agency. In many parts of the world, this reporting is mandatory. (See "Child abuse: Social and medicolegal issues", section on 'Reporting suspected abuse'.)

RED FLAG HISTORY

Certain specific historical features are associated with abuse and should raise suspicion. Consistent with the American Academy of Pediatrics guidelines for evaluation child physical abuse, we recommend careful evaluation for abuse for significantly injured children with any of the following (table 2) [2]:

- No history or denial of trauma despite severe injury [50,51]

- Implausible history for degree or type of injury

- Unexplained or excessive delay in seeking care

- Severe injury explained as self-inflicted or blamed on other young children or pets

- Caregiver histories that change with retelling or conflict with versions from other observers [50,52]

Although uncommon, some cases of physical abuse come to light based upon history from an observer or the victim. For this reason, it is best to interview a verbal child about a suspicious injury without caregivers present whenever possible.

Unexplained major trauma — Lack of an explanatory history in a patient with major trauma (eg, subdural hematoma or long bone fractures) is a strong marker for abuse [50,52]. For example, among 163 children admitted for an acute traumatic intracranial injury, the absence of any explanatory history predicted abuse with 69 percent sensitivity and 97 percent specificity [50]. Of 66 children admitted to two children's hospitals for subdural hematoma, 17 of 39 abused, 4 of 12 indeterminate, and 0 of 15 accidentally injured children had no history [51]. (See 'Approach' above.)

Significant injuries in children should be well explained by their history in most situations. Infants and young children should be closely supervised by adults. They also lack the independence and motor skills to get into dangerous circumstances without their caregiver's knowledge unless they are being neglected. Thus, with unintentional injuries in these patients, an adult should provide a credible history for any significant injuries.

Implausible mechanism of injury — Two major types of implausible mechanisms that may be provided by perpetrators of child abuse are:

- **Inadequate mechanism to explain severity** – Serious, internal injuries raise concern for abuse when an inadequate mechanism of injury (eg, short fall or fall down the stairs) is provided by the caregiver.

  Falls are among the commonest causes of early childhood injury. A short fall of <3 feet is also the most commonly given false trauma history accompanying abusive head injury [50]. Among 66 children admitted to two children's hospitals with subdural hematoma, 16 of 39 abused, 5 of 12 indeterminate, and 0 of 15 accidentally injured children had a history of a less than 4-foot fall [51]. Determining the likely outcome of such a fall must rely upon confirmable fall events. Trauma events, principally falls, are the most commonly studied examples in hospitals. Six observational studies have described the injuries sustained after falls from cribs or beds in 1174 children ranging from newborn to 16 years of age [53-58]. Of these patients, none sustained symptomatic intracranial injury, though several had a brief period of altered mental status without intracranial bleeding. One long bone fracture occurred in a child with known osteogenesis imperfecta, and one clavicle fracture occurred. There were 10 skull fractures.

  Authors have looked at a multitude of special fall scenarios, including bunk beds, stairways, highchairs, or walkers [59-69]. As elevation and child ability increases, injury severity increases, though serious intracranial injury remains rare for indoor falls. A literature review explored whether intestinal perforation could be explained by a fall downstairs and found that none of the 312 cases of intestinal perforation were due to falls

[69]. Similarly, fatalities from short indoor falls are extremely rare, occurring in perhaps 1 in 2,000,000 children per year [70,71].

As children become more capable and independent, they also become verbal, and may supply their own history. However, in the late toddler and early preschool ages, children may be active and independent enough to injure themselves unintentionally, but lack sufficient communication skills to explain what happened. Minor injuries in these children are expected, and not always explained. Serious and internal injuries, however, still raise concern for abuse when an appropriate mechanism of injury is **not** provided by the caregiver.

- **Developmentally improbable behavior by the child** – A history that calls for developmentally improbable child behavior (eg, a scald burn in a 9-month-old attributed to the infant "turning on the hot water faucet") should also be seen as suspicious. Recognition of these false histories requires knowledge of normal developmental milestones and the range of normal motor skills by age.

  Because inflicted burns must be differentiated from injuries caused by the child themselves, young children's ability to climb into a bathtub has been specifically evaluated. Children as young as 10 months old begin to climb into a tub, and, by 15 months of age, 50 percent of children can accomplish this [72]. By extension, a history of scaling any low barrier, such as a baby gate or a crib rail, must be considered at these ages.

  The timing of typical developmental milestones is shown in the tables and reviewed separately (table 3 and   table 4). (See "Developmental-behavioral surveillance and screening in primary care", section on 'Approach to surveillance'.)

Delay in seeking care — Delays that complicate care, prolong pain, or that occur in children with obvious, severe distress (eg, actively seizing, coma, or respiratory distress) are suspicious for abuse.

Delay in seeking care after an injury is more common in abuse cases when compared with unintentional injury [73-75]. However, there is a great deal of overlap for children who are injured **without** an obviously severe mechanism such as a motor vehicle collision. For example, one retrospective study of 121 children admitted to a single center for intraabdominal injury showed that 35 percent of children with low-velocity mechanisms of injury presented for care >12 hours after the injury compared with 54 percent of abused children [73]. In another study of 206 children younger than 6 years of age with accidental extremity fractures, 21 percent were seen more than eight hours after the injury [74]. Finally, among 105 children receiving care for

burns in a pediatric emergency department, treatment delay beyond 24 hours was found in 19 percent of those children ultimately reported to child protection services compared with 6 percent of children who were not [76]. Thus, delay in seeking care by itself has a low specificity for abuse.

Injuries attributed to young children or pets — Siblings are known to injure each other, but serious injury inflicted by a sibling is a rare occurrence in our experience. Serious injury blamed on other young children may be a potential sign of abuse [76,77]. As an example, in one series of 105 children evaluated for burns in a pediatric emergency department, 38 percent of children reported to child protection had a history of the sibling causing the burn compared with 6 percent of children for whom a report was not filed [76].

Although not well-described in the literature, our experience suggests that pets are sometimes blamed for severe injuries (eg, "the dog knocked the child over").

RED FLAG PHYSICAL FINDINGS

Any concern for physical abuse should result in a thorough physical examination, with specific attention to the following regions (table 1):

- Scalp and fontanels
- Ears
- Oral cavity, including the buccal mucosa, labial and lingual frenula; the teeth; and the posterior pharyngeal wall
- Folds of the neck
- Buttocks
- Genitals
- Palms and soles

However, not all findings that appear abusive in nature actually result from abuse. The differential diagnosis of these findings and the diagnostic evaluation of suspected child abuse are discussed separately. (See "Differential diagnosis of suspected child physical abuse" and "Physical child abuse: Diagnostic evaluation and management".)

Inflicted bruises — Bruising is the most common form of both unintentional and abusive injury. The age of the child and the nature, shape, location, distribution, number, and size of bruises may each contribute to a concern for abuse as follows:

- Any bruising in infants younger than 6 months of age [78-81]

- More than one bruise in a pre-mobile infant and more than two bruises in a crawling child [82]
- Bruises located on the torso, buttocks, ear, neck, angle of the jaw, fleshy cheek or eyelid. [81,83,84]
- Laceration of the oral frenulae [81].
- Subconjunctival hemorrhages [81,85,86]
- Bruises with a pattern of the striking object (figure 1) (eg, slap, belt, or loop marks (picture 1); spoons; spatulas; or other objects) [87,88]
- Bruises with other previously reported, abuse-associated, pattern [89-91]
- Human bite marks [92,93]

The appearance of bruises should **not** be used to determine the timing of injury. Previously, the age of bruising relative to the timing of injury based upon history was sometimes used to raise suspicion for abuse. However, timing of bruises by physicians and forensic experts based upon color, tenderness, or swelling have poor interrater reliability and low accuracy, especially as bruises age [94,95]. Similarly, published tables that determine the age of a bruise using its color are inaccurate and misleading and should **not** be used.

Evidence supporting the increased likelihood of abuse based upon bruising characteristics is as follows:

- **Patient age** – Any bruising in babies who are not independently mobile is concerning for abuse, especially bruising to the ears, face, neck torso, and buttocks. An isolated bruise may be the only obvious indication of physical abuse. As an example, among children younger than 6 months of age referred for an abuse evaluation for apparently isolated bruising, 50 percent had an additional traumatic injury (fracture, brain injury, and/or abdominal injury) identified [78]. The clinical prediction rule TEN-4-FACESp gains significant sensitivity by including all bruised children under age five months [81]. Among 200 infants younger than 12 months of age who were abused, 27 percent had a past "sentinel" injury, compared with 8 percent of 100 children with intermediate likelihood of abuse and none of the 101 children with no concern for abuse [37]. Eighty percent of these sentinel injuries were bruises.

  Bruising is uncommon among healthy infants younger than 6 months of age who have not been abused, occurring in approximately 0.5 to 1 percent of patients seen during well care and emergency department visits [79,80]. This finding contrasts with observed rates of bruising from 18 to almost 50 percent of infants who are cruising or crawling [79,82]. The majority of walking children have bruises.

As infants get older, the frequency of bruising rises, even before they learn to pull to a stand and walk with support or "cruise." A study that followed infants for up to 12 weeks found that approximately 7 percent of pre-mobile children, from birth to 11 months old, had bruises at some point during that period [82]. During evaluation of infants without a concern for abuse who presented to a pediatric emergency department, about 6 percent of patients 6 months of age and older had bruises compared with approximately 1 percent of infants younger than 6 months of age.

- **Location and number** – The most concerning bruising locations are summarized by the mnemonic "TEN-4-FACESp," which references [81,83]:

  - Bruising to the torso, ear, and neck in children <4 years old
  - Frenulum tear
  - All bruises in children ≤5 months old
  - Bruising of the angle of the jaw, fleshy cheek, eyelid, or sclera
  - Any bruise with a pattern

  In a multicenter validation study of over 2100 children with at least one bruise, the TEN-4-FACESp rule identified abuse with a sensitivity of 96 percent (95% CI 93-97 percent) and a specificity of 87 percent (95% CI 85-89 percent) with a positive predictive value of 64 percent (95% CI 60-68 percent, prevalence of abuse 19 percent) [81]. In addition, the presence of petechial bruising is more likely in abused children <6 years old compared with unintentionally injured children (likelihood ratio for abuse 8.1) [96].

  The most common locations of unintentional bruises include the scalp, knee, shin, or thigh, though other areas, particularly the back, forearms, nose, or cheek, are sometimes injured in mobile children [79,82,87,97]. Pre-mobile children seldom have more than one bruise, and crawlers and cruisers seldom more than two, but walkers commonly had five or more bruises [82]. The majority of walking children have bruises which are typically multiple.

- **Patterned injuries** – Objects that deliver a highly concentrated force tear blood vessels in deep tissue. These tend to produce ecchymotic lesions that have blurred margins and a delayed appearance [88]. These bruises may be a positive image of the impactor, though central clearing is known to occur. Examples are bites, punches, grip marks (picture 2A-B), and most unintentional injuries.

  Objects that have a high impact velocity, but diffuse their energy over a broad contact area shear dermal capillaries at their margins [88]. These tend to produce marginal petechiae that form an outline of the impacting object. These lesions often appear very

shortly after trauma, initially have sharp margins, and may disappear quite rapidly. Examples include slap marks, belt marks (picture 3), loop-of-cord marks (picture 1), switches, spatulas, spoons, hangers, or other objects (figure 1). Sometimes these objects will also break the skin, forming superficial lacerations. Patterns are unusual in unintentional injury and provide an objective basis for assessing the truthfulness of an explanatory history.

The presence of a bruise with identifiable shape had a likelihood ratio of 25.8 and occurred in fewer than 2 percent of non-abused children in one case-control study [87].

Most unintentional bruises are oval, anterior, and over bony prominences. Impacts by an object may leave a bruise that retains the shape of that object (figure 1). Other abuse-associated bruising patterns lack the imprint of the impacting object but have a stereotypical appearance that can be recognized, including palmar bruises due to tight squeezing of the child's clenched fist; linear, bilateral bruising to the buttocks that run parallel to the inter-gluteal cleft; and apical bruising of the pinna caused by a direct blow [84,89-91].

- **Bite marks** – Human bite marks consist of facing semi-lunar rows of box-shaped ecchymosis [92,93]. Dog bites, by contrast, have a long, narrow arch with prominent canines that commonly puncture the skin [98]. The pattern of tooth imprints can differentiate between adult and child assailants and possibly match a particular assailant. While there is no threshold that perfectly discriminates between a child or adult biter, a maxillary intercanine distance of >30 mm is generally considered to suggest an adult biter [92,93]. This determination must be represented cautiously, as research suggests that distinguishing between adult and child bites has limited accuracy, with an area under the receiver operator curve of 0.69 for the most experienced examiner [99]. Bite marks may also yield saliva and DNA, which can be collected using standard methods of evidence collection, as in cases of acute sexual assault [100]. Patterned injury, and particularly bite marks, should be photographed, with a size standard in the photo. The size standard should be at the same distance from the camera as the injury, and the size standard, injury, and camera back should all be in parallel planes.

Oral injuries — The following oral injuries raise concern for abuse [81,101-104]:

- Lip lacerations or bruising, especially in nonambulatory infants
- Lingual or labial frenulum tears, especially in nonambulatory infants
- Tongue lacerations, especially in nonambulatory infants

- Bruising or wounds of the buccal mucosa, gums, or palate, especially in nonambulatory infants
- Missing or fracture teeth with an absent or implausible history
- Maxillary or mandibular fractures with an absent or implausible history
- Bruising, lichenification, or scarring at the corners of the mouth from being gagged

Frenulum tears may occur from accidental injury (as among ambulating toddlers) or from abusive mechanisms, such as force feeding or "bottle jamming" in young infants [35].

Intentional burns — Abusive burns arise from scalds, contact with heated objects, flame, chemical exposure, microwave, other radiation, and electrical currents.

Physical findings of intentional burns include:

- Scalds in children younger than 5 years of age that do not fit the pattern of an unintentional spill [105,106]

- Scalds from hot tap water due to immersion, demonstrating a sharp upper line of demarcation ("high tide mark"), affecting both sides of the body symmetrically, or involving the lower extremities and/or perineum (picture 4 and picture 5 and picture 6) [105,106]

- Burns that have a sharply demarcated edge in the shape of the burning object (figure 2) (eg, clothing iron (picture 7), spatulas, spoons, grates, metal hair dryer grids, curling irons, or the metal tops of butane cigarette lighters) [107,108]

- Cigarette burns that appear as discreet circular burns 8 to 12 mm in diameter and are deep (eg, third degree burns) [109,110]

- Stun gun burns usually are multiple and appear as paired lesions approximately 0.5 cm in diameter and 5 cm apart [111,112]

- Deep partial-thickness and full-thickness burns [113]

- Burn extent >20 percent body surface area [113]

- Burns to the posterior trunk, buttocks, or genitals [114]

- The presence of additional injuries, other than the burn [113]

All of the above findings have greater significance as the child's age decreases. The peak age for abusive burning is in the third and fourth years of life and is frequently related to

punishment for toilet-training mishaps.

Additional features of burns caused by abuse are as follows:

- No history of how a significant burn or burn scar occurred

- A history inconsistent with physical findings (eg, a brief [few seconds] exposure to bathtub water resulting in extensive second degree burns and independent determination of hot water temperature that gives a reading <49°C [120°F])

- The presence of other abusive injuries (eg inflicted bruises or fractures) [115]

- Scald burns, especially if bilateral and symmetric, involving the perineum, full thickness (third degree) (table 5), and >10 percent of the body surface area (figure 3) [106,116,117]

Other burn characteristics have been used to identify burns from their appearance.

- **Scalds** – Scalds from hot tap water due to immersion, demonstrating a sharp upper line of demarcation ("high tide mark"), affecting both sides of the body symmetrically, or involving the lower extremities and/or perineum are more likely to be inflicted (picture 4 and picture 5 and picture 6). Inflicted scalds are more likely to occur in children younger than 5 years of age [105]. Immersion of a child into a tub of hot water is a particularly recognizable abusive pattern [106]. These burns appear complex at first glance, but placing the child in the position they assumed while being burned will produce a planar superior delimitation of the burn, and fold unburned creases below this plane together so that they exclude the burning fluid. Sometimes the most dependent part of the body will be unburned, as it was pressed against the bottom of the tub during burning. Based upon two observational studies, scalds are the most common.

  Unintentional hot fluid burns commonly occur due to spills. They usually involve the hand, forearm, shoulder, face, and upper chest when a child reaches up and pulls down a cup or pot of hot water or oil [107]. Scald injuries are more likely to be abusive when they are posterior, bilateral, and involve the buttocks, lower extremities, or both [105].

  Evaluations of tap-water burns are best coordinated with an agency (eg, the regional fire department) that can go to the field, replicate the given history, and measure the temperature of any water at the tap, and within any involved vessel. This permits a given history to be tested. A relationship between exposure time, water temperature, and burn depth was developed for adults and applied to children [118,119]. The time needed to produce a partial thickness burn is exponentially and inversely related to temperature.

While such burns require contact for several minutes if liquids are <49°C (120°F), burns can occur in seconds if fluids are >66°C (150°F). Circumstances that require a long immersion time, but in which the burn pattern indicates a static sustained contact, would require an unresponsive or immobilized child, also creating concern for abusive injury.

- **Contact burns** – Burns that have a sharply demarcated edge in the shape of the burning object are more common in abuse than accidental injury (figure 2) [108]. Examples include spatulas, spoons, grates, metal hair dryer grids, clothes irons, curling irons, and the metal tops of butane cigarette lighters. Among abused children, one-third of these burns were multiple, and two-thirds of multiple burns were on the face [108].

  Children may be burned by heated objects when they move against the object, when the object falls on them, and when they grab the item. As a result, accidental burns usually lack a well-demarcated edge, and affect the palm of the hand or the front of the body [107]. Usually these burns only affect one site, but bilateral palm or sole burns have occurred when children walked onto or leaned against hot surfaces.

- **Cigarette burns** – Inflicted cigarette burns are usually discreet circular burns 8 to 12 mm in diameter. Sustained contact or displacement of the ash is necessary to produce a third-degree burn, identifying such burns as deliberately inflicted [109,110].

  By contrast, with an inadvertent cigarette burn, the lit end of a cigarette, which can be several hundred degrees, is typically insulated with a cooler ash. Thus, when a child runs, walks, or falls against a lit cigarette, the resulting burn is typically irregular, isolated, and superficial.

The use of a checklist attached to all emergency department burn charts resulted in an increase in the identification of possible abuse from 3 to 12 percent of all burns [76,77]. Subsequently, a clinical prediction rule has been derived to predict abuse in burned children and consists of the following high-risk features [120]:

- Age <5 years
- Full-thickness burn
- Symmetric scalding on both sides of the body
- Atypical location of a scald burn such as back, buttocks, groin, or within the hairline
- Lack of adult supervision, especially in a child <5 years old
- Bathing scald
- History implausible because explanation is inconsistent with the child's developmental stage or does not fit the scald pattern
- Current or previous child protection involvement

Although it awaits validation in a large prospective cohort, preliminary results suggest that it shows promise for helping with the decision to proceed with a child protection evaluation in children with burns [121].

Fractures — Fractures that suggest child abuse may come to light as an incidental finding during radiologic evaluation or as part of a skeletal survey when a concern for abuse is present. The skeletal survey (table 6) is widely regarded as the best method for detecting fractures in children who have been abused.

Concern for physical abuse in children younger than 24 months of age is an absolute indication for obtaining a skeletal survey. Other indications for ordering a skeletal survey are discussed separately (table 7). (See "Physical child abuse: Diagnostic evaluation and management", section on 'Skeletal survey'.)

Fractures that are highly suggestive of intentional injury include (see "Orthopedic aspects of child abuse", section on 'Fracture patterns'):

- Metaphyseal corner (or bucket handle) fractures (image 1 and image 2 and image 3 and figure 4)
- Rib fractures (image 4)
- Fractures of the sternum, scapula, or spinous processes
- Long bone fracture in a nonambulatory infant
- Multiple fractures in various stages of healing (image 5)
- Bilateral acute long bone fractures
- Vertebral body fractures and subluxations in the absence of a history of high force trauma
- Digital fractures in children younger than 36 months of age or without a corresponding history
- Epiphyseal separations
- Severe skull fractures (eg, multiple, stellate, or depressed) in children younger than 18 months of age, particularly without a corresponding history

Fractures with less specificity for abuse include:

- Isolated long bone fractures in ambulatory children
- Linear skull fractures
- Clavicle fractures
- Subperiosteal new bone formation

With every fracture, the possibility of inflicted injury must be considered, based upon the age of the child, overall injury pattern, stated mechanism of injury, and pertinent psychosocial factors.

Any fracture in an infant or young child is potentially concerning for child abuse. Orthopedic aspects of child abuse, including abusive fracture patterns and interpretation of findings is discussed separately. (See "Orthopedic aspects of child abuse".)

Serious injury without explanation — Internal injuries of the head, thorax, and abdomen are the most severe forms of child physical abuse. Even so, the spectrum of inflicted internal injuries includes entirely occult conditions that can be overlooked or silent.

 Abusive head trauma — In children with intracranial injuries, no single physical finding definitively identifies abusive head trauma (AHT). However, features that are most predictive of child abuse include intracranial hemorrhage (especially a subdural hemorrhage) and any one of the following (see "Child abuse: Evaluation and diagnosis of abusive head trauma in infants and children", section on 'Diagnosis'):

- Inadequate history (eg, no history of trauma, or a history that is inconsistent with the severity of the head injury)
- Apnea or seizures on presentation
- Associated fractures of the ribs, metaphyseal region, or long bones (see 'Fractures' above)
- Retinal hemorrhage(s) (see "Child abuse: Eye findings in children with abusive head trauma (AHT)")
- Any skull fracture other than an isolated, unilateral, nondiastatic, linear, parietal skull fracture
- Any bruising of the child's ears, neck, or torso (see 'Inflicted bruises' above)

The evaluation, epidemiology, and associated eye findings in children with AHT are discussed separately:

- (See "Child abuse: Evaluation and diagnosis of abusive head trauma in infants and children".)

- (See "Child abuse: Epidemiology, mechanisms, and types of abusive head trauma in infants and children".)

- (See "Child abuse: Eye findings in children with abusive head trauma (AHT)" and "Child abuse: Anatomy and pathogenesis of retinal hemorrhages after abusive head trauma".)

 Visceral injuries — Diagnosis of a severe esophageal, pulmonary, cardiac, or abdominal injury in a child with a questionable or absent mechanism of injury is an important red flag for abuse, especially when it occurs in children younger than 4 years of age [122]. Victims of inflicted

visceral injury often have other findings of abuse such as head injury, fractures, or cutaneous findings.

Inflicted abdominal trauma can be caused by direct blows or kicks to the abdomen, or by direct pressure (eg, standing or kneeling on the abdomen) which cause injury or rupture of the hollow organs (eg, duodenal hematoma, traumatic pancreatitis, or bladder rupture) or contusion or laceration of the solid organs (eg, liver, spleen, or kidneys) [122].

Serious abdominal injury after inflicted blunt trauma may be indicated by abdominal tenderness, abdominal distension, enlargement of the liver or spleen, or abdominal wall bruising. However, based upon a systemic review of five observational studies that compared a total of 68 abused children with 488 children injured unintentionally, nonspecific historical features such as vomiting or fussiness may be the only symptoms and few overt signs may be present on physical examination, including lack of cutaneous bruising [122]. Thus, evaluation for occult abdominal injury is an important part of any child abuse evaluation. (See "Physical child abuse: Diagnostic evaluation and management", section on 'Screening studies' and "Physical child abuse: Diagnostic evaluation and management", section on 'Abdominal injury'.)

Relative to children with unintentional abdominal injury, abused children more frequently have:

- Young age (<4 years) [73,122-127]

- High central abdominal injury, particularly perforation or hematoma of the duodenum or proximal jejunum or pancreatic disruption [73,125-127]

- Delayed presentation [73,122,125,126,128]

- Fatal injury [122]

Duodenal perforation or hematoma is especially rare in pediatric trauma patients; a systematic review of 88 studies found no duodenal injuries among 488 children with unintentional abdominal injuries requiring hospital admission [122].

Although a potential marker for abuse, delay in presentation has been described with unintentional abdominal injuries (eg, splenic laceration from a bicycle handlebar injury and jejunal perforation after falling onto a rock) [122].

The medical and/or surgical management of these injuries is discussed separately. (See "Thoracic trauma in children: Initial stabilization and evaluation" and "Pediatric blunt abdominal trauma: Initial evaluation and stabilization".)

Suspicious parent behaviors — The behavior of the parents and the interaction between family members should be observed carefully during the evaluation of the child. In addition to the red flag history features described above, the following behaviors are of concern (see "Physical child abuse: Diagnostic evaluation and management", section on 'Family interaction'):

- Arguing, roughness, or violence.

- Aloofness and lack of emotional interaction between parents or between parents and children.

- Inappropriate response to the severity of the injury (eg, lack of appropriate concern).

- A partial confession by the parent (eg, "I hit him, but not that hard") or a frank admission by parent that injury was inflicted. Such confessions occur occasionally and are an indication that the parent realizes that abuse is a problem and is seeking help.

ADDITIONAL FACTORS

Young age, a prior history of abuse in the household, and certain social factors (eg, domestic violence, substance abuse or psychiatric illness in the caregiver, family stressors, or caregiver social isolation) can raise the level of concern for abuse in equivocal cases.

We recommend using factors other than race and socioeconomic status to determine the approach to testing or reporting of child abuse. Demographic factors that may guide efforts at prevention are discussed separately. (See 'Epidemiology' above.)

While several studies have shown associations between demographic factors such as race and socioeconomic status and abuse, these associations are **not** useful in the evaluation of an individual patient. Based upon observational studies, clinicians may perform more testing (eg, skeletal surveys) and make more reports to child protection services when evaluating minority children or children with low socioeconomic status when compared with the evaluation of White children or those with higher socioeconomic status [43-45,129-131].

When medical findings are suggestive of innocent injury, demographic and environmental factors may support intervening to aid the family and lessen risk. When medical findings are suggestive of abuse, even children from low risk groups and privileged backgrounds must be protected. Only when medical indicators are equivocal should demographic and environmental factors prompt a consideration of protective action.

Young age — In injured children, the likelihood that the injury is the result of abuse rises dramatically for younger children. Twenty-seven percent of maltreatment victims are less than 3 years old, and among fatally abused children, 47 and 81 percent were among children less than 1 year old or less than 4 years old, respectively [132]. Fifty percent of investigated infants younger than 6 months of age with apparently isolated bruising had unexplained internal injuries suggesting abuse [78]. In children younger than four years of age evaluated at a major children's hospital, the average age of abused traumatized children was 12 months, while that of non-abused children on the trauma registry was 22 months [133]. In virtually all studies of abusive head trauma or visceral injury, abused children are significantly younger than their non-abused counterparts [134-136]. While this trend holds in all forms of injury, the significance of the child's specific age varies with the injury under consideration. However, as noted in the American Academy of Pediatrics guidelines, younger age is an important factor when determining the need for an abuse evaluation and reporting to child protection services [2].

Prior abuse in the household — Prior known abuse of a child or sibling should increase the level of concern for abuse. For some patients, obtaining the history of prior abuse requires phone consultation with the primary care provider or the regional child protection services.

Being on a government child protection registry has a likelihood ratio for abuse of 12.4 for infants and just over 4 for older children presenting to an emergency department [137]. When physically abused infants known to children's protective service agencies are returned to their families, 30 percent experience second abusive events including repeated physical abuse in 16 percent [33]. In 2013, about 12 percent of United States child abuse fatalities were receiving children's protective service agencies services at the time of their death [132]. Among siblings younger than 2 years of age or household contacts of abused, injured children, skeletal survey identified abusive fractures in 12 percent. This rose to 41 percent in siblings younger than 6 months of age and 56 percent among twins [138]. We recommend careful evaluation for abuse for all children who present with injuries after a prior diagnosis of abuse and for siblings of abused children. (See "Physical child abuse: Diagnostic evaluation and management".)

Social factors — Presence of the following factors on social history raises the level of concern for abuse when medical findings are equivocal and support additional investigation (see 'Epidemiology' above):

- Child characteristics:

  - Failure to thrive
  - Unwanted child

- Environment:

- Domestic or intimate partner violence
- Animal cruelty
- Acute or chronic family stressors (eg, divorce or interpersonal conflict, illness, or job loss)
- Social isolation (distant or absent extended family)

- Caregiver features:

  - Unrealistic expectations for child; poor knowledge of child development [29]
  - Negative perception of normal child behaviors
  - Substance or alcohol abuse
  - Psychiatric illness (eg, depression, impulse disorder)

SCREENING IN PRIMARY CARE SETTINGS

Evidence is lacking to support universal screening for abuse in the primary care office [139]. Until better formal methods are developed which have acceptable accuracy and can be easily implemented, we favor the broad distribution and use of current guidelines among all pediatric health care providers to enhance general awareness and to support timely recognition of child physical abuse. (See 'Society guideline links' below.)

SCREENING IN THE ACUTE CARE SETTING

The approach to recognition of physical child abuse is increasingly being augmented with systematic supports for the recognition of physical child abuse. Early efforts were the use of checklists, as has been mandated in the Netherlands. Use of these checklists has increased the recognition of physical child abuse [140]. Several researchers have developed and studied standardized methods for detecting injuries that may have been inflicted [141-144]. Typically these methods have been developed for use in the emergency department, and flag the records of patients with an evaluation tool to be completed by the evaluating clinician (table 8). Developers of these screens suggest that the tools may increase the rate at which child abuse is considered, detected, and reported; and that they lead to improved documentation of the child abuse assessment [140,145-149].

Though some checklists call for medical providers to make judgment calls about parent behavior or history credibility, which creates opportunity for social bias to influence their judgment, there is some evidence that use of a checklist based upon consensus guidelines will decrease overall bias in child abuse suspicion and reporting [150,151]. As an example, in an

observational study of a universal child abuse screening tool in multiple emergency departments that saw over 104,000 children during the study, there was a significant increase in the rate of detection of child abuse among screened children when compared to children who were not screened (0.5 versus 0.1 percent, respectively) [147]. During the study, use of the screening tool increased from 20 to 67 percent. Another study in a single center evaluated the impact of the same screening tool or a mandated top-to-toe examination, and the two methods together. Among almost 10,000 children so screened, 4 percent had a positive screen for abuse on either screening, physical examination alone, or both [140]. A final diagnosis of abuse was given in 0.9 percent of the full cohort and over 40 percent of screen-positive children. In addition, the screening tool led to more detection of child abuse cases. The tools in these two studies were sensitive, producing few false negatives, but had low specificity and resulted in false positives. Whether, on balance, these screening tools can be beneficial in practice will depend on how a positive screen is managed; the tools are meant to prompt careful consideration of abuse but do not, by themselves, mandate laboratory testing, radiographic studies, or child protective services reporting.

The low accuracy and difficulty in obtaining consistent use of these instruments in routine practice raise concerns regarding their utility. For example, in a multicenter prospective observational study of a validated child abuse screening tool during over 38,000 child emergency department visits, fewer than half of the patients had the instrument completed and only 420 were positive [149]. Sensitivity and specificity of the tool was 80 and 98 percent, respectively. Negative predictive value for the screening tool was 99 percent and positive predictive value was 10 percent. A total of 89 patients were referred for a child abuse evaluation and 55 were judged to have been abused (prevalence 0.1 percent). In a systematic review of the diagnostic accuracy of screening tools designed to detect child abuse, sensitivity ranged from 26 to 97 percent and specificity from about 50 to 100 percent [152]. Several of these instruments only detected children when they had clinical symptoms.

Thus, development of more accurate tools that can be easily implemented in practice is needed before routine screening of ambulatory children for abuse can be recommended. One possibility is to build screening tools around "sentinel injuries" that have an epidemiologic association with inflicted injury (table 1) [48,153,154]. It has been shown that clinicians have limited knowledge regarding injuries that ought to prompt abuse concerns [155]. Clinical pathways that are based upon sentinel injuries as proposed by consensus guidelines have been associated with the increased use of skeletal surveys and child abuse specialist consultation while potentially reducing social bias [48,154].

Another proposed answer is the use of automated supports integrated into the electronic medical record, such as pop-up alerts and clinical decision support tools. Several such tools have been developed in both academic and community hospital settings [156-160]. Impact on abuse suspicion and decision to evaluate for abuse appears variable depending upon the specific type of clinical decision support system and the setting in which it is implemented. Further study is needed to determine whether alerts and clinical decision support improve compliance with clinical guidelines.

ADDITIONAL RESOURCES

Additional data, evidence, and educational material related to child abuse can be found at the following links:

- Centers for Disease Control and Prevention

- Child Protection Evidence

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Child abuse and neglect" and "Society guideline links: Pediatric trauma".)

SUMMARY AND RECOMMENDATIONS

- **Definition** – Physical child abuse may be broadly defined as injury inflicted upon a child by a parent or caretaker. Specific definitions can vary widely among countries, as well as among different ethnic and religious groups. (See 'Definition' above.)

- **Epidemiology** – Physical child abuse accounts for thousands of injuries and deaths annually throughout the word. Recognition is essential because abused children who are returned to an abusive environment without intervention are highly likely to be maltreated again and are at an increased risk for death. (See 'Epidemiology' above and 'Risk factors' above.)

- **Approach** – We provide an approach to facilitate recognition of child abuse that emphasizes (see 'Approach' above):

- Actively maintaining child abuse in the differential diagnosis of trauma and puzzling medical presentations

- Careful evaluation for findings of abuse on history and physical examination (see 'Red flag history' above and 'Red flag physical findings' above)

- Utilization of multidisciplinary child abuse teams as consultants

- Prompt reporting of suspected child physical abuse to the appropriate governmental agency

  Young age, a prior history of abuse in the household, and social factors (eg, domestic violence, caregiver substance abuse or psychiatric illness, presence of family stressors, or family isolation) can also raise the level of concern for child physical abuse in equivocal cases. However, race or socioeconomic status should **not** be used to determine the need for further abuse evaluation. (See 'Additional factors' above.)

- **Red flag findings** – For children with red flag history or physical examination findings associated with physical child abuse (table 1 and table 2), we recommend a complete evaluation for physical child abuse (table 9). Consultation with a multidisciplinary child abuse team that includes a child abuse specialist is optimal, where available, and may support transfer to a center with these resources. (See 'Red flag history' above and 'Red flag physical findings' above.)

  The diagnostic evaluation of physical child abuse is discussed separately. (See "Physical child abuse: Diagnostic evaluation and management" and "Child abuse: Evaluation and diagnosis of abusive head trauma in infants and children".)

- **Physical child abuse screening** – Evidence is lacking to support universal screening for physical child abuse. Until better formal methods are developed which have acceptable accuracy and can be easily implemented, we favor the broad distribution and use of current guidelines among all pediatric health care providers to enhance general awareness and to support timely recognition of physical child abuse. (See 'Screening in primary care settings' above and 'Society guideline links' above.)

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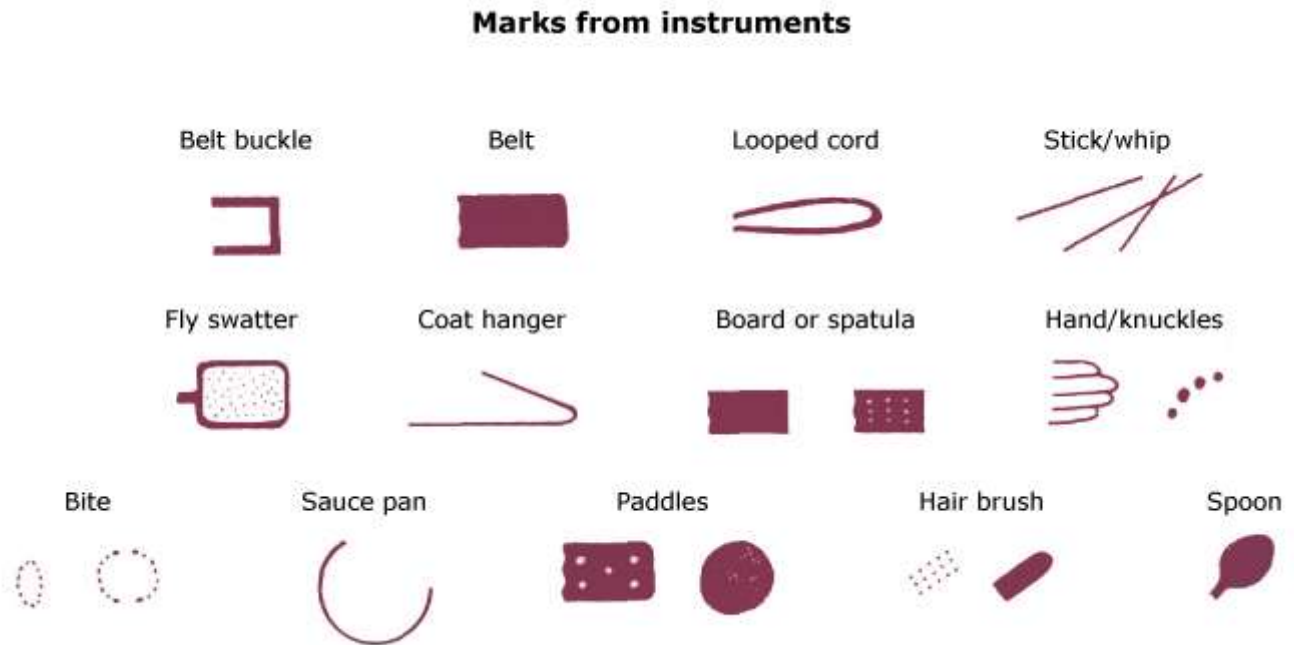
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Topic 103420 Version 29.0

Bruising patterns that suggest child abuse

Marks from instruments

Belt buckle	Belt	Looped cord	Stick/whip
Fly swatter	Coat hanger	Board or spatula	Hand/knuckles
Bite	Sauce pan	Paddles	Hair brush	Spoon

A variety of instruments may be used to inflict injury on a child. Often the choice of an instrument is a matter of convenience. Marks tend to silhouette or outline the shape of the instrument. The possibility of intentional trauma should prompt a high degree of suspicion when injuries to a child are geometric, paired, mirrored, of various ages or types, or on relatively protected parts of the body. Early recognition of intentional trauma is important to provide therapy and prevent escalation to more serious injury.

Graphic 109368 Version 1.0

Contact burn patterns suggesting abuse

Burn marks

Hot plate	Light bulb	Curling iron	Car cigarette lighter	Steam iron

Knife	Grid	Cigarette	Forks	Immersion
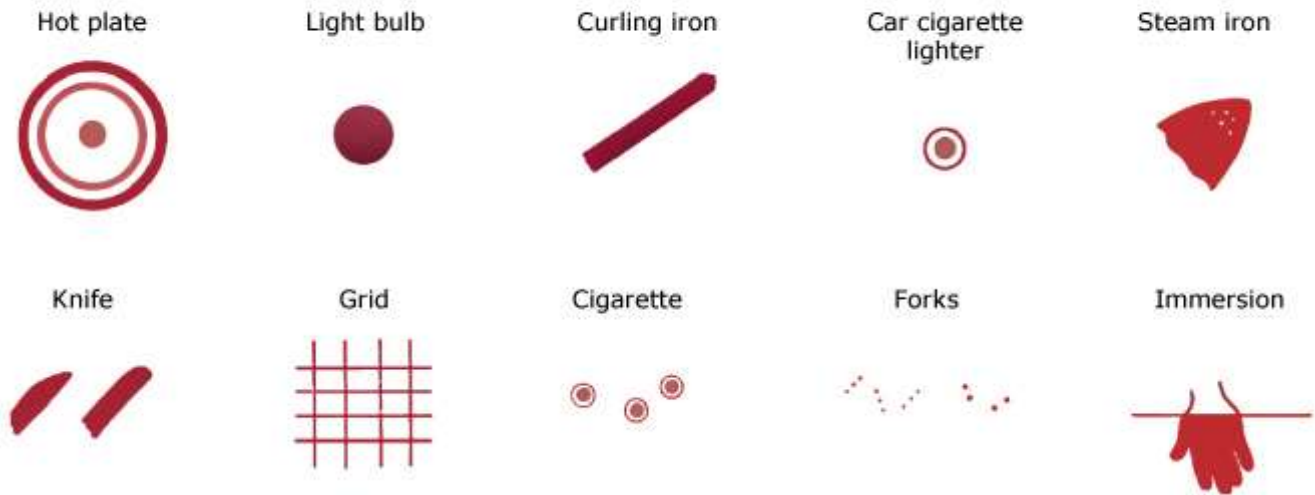
Marks from heated objects cause burns in a pattern that duplicates that of the object. Familiarity with the common heated objects that are used to traumatize children facilitates recognition of possible intentional injuries. The location of the burn is important in determining its cause. Children tend to explore surfaces with the palmar surface of the hand and rarely touch a heated object repeatedly or for a long time.

Graphic 109369 Version 1.0

Sentinel injuries suggesting physical child abuse in infants and young children

Injury	Patient age			
	<6 months	**6 to 12 months**	**1 year old**	**2 to 3 years old**
Soft tissue injury	Frenulum tears or unexplained oral injuries (teeth, lips, palate)	Frenulum tears or unexplained oral injuries (teeth, lips, palate)	Frenulum tears or unexplained oral injuries (teeth, lips, palate)	Frenulum tears or unexplained oral injuries (teeth, lips, palate)
	Isolated subconjunctival hemorrhage outside of the newborn period			
	Any bruise	Unexplained bruises in non-cruising children		
		Bruises of the trunk, ear, neck, jawline, or cheek	Bruises of the trunk, ear, neck, jawline, or cheek	Bruises of the trunk, ear, neck, jawline, or cheek
		Patterned bruising	Patterned bruising	Patterned bruising
Burns	Unexplained burns	Unexplained burns	Unexplained burns	Unexplained burns
	Burns in the shape of a heated object	Burns in the shape of a heated object	Burns in the shape of a heated object	Burns in the shape of a heated object
	Immersion burns	Immersion burns	Immersion burns	Immersion burns
	Burns of the perineum **and** lower extremities	Burns of the perineum **and** lower extremities	Burns of the perineum **and** lower extremities	Burns of the perineum **and** lower extremities
Fractures	Multiple fractures in different stages of healing	Multiple fractures in different stages of healing	Multiple fractures in different stages of healing	Multiple fractures in different stages of healing
	Any fracture other than skull or clavicle	**Any** fracture other than skull fracture	**Any** rib fracture	Fracture without trauma

	fractures in the newborn period	Skull fractures without history or other than simple linear parietal type	Humerus fracture, other than supracondylar Fractures of other long bones Fracture without trauma history or presenting with evidence of healing	history or presenting with evidence of healing
Intracranial	**Any** subdural hemorrhage/hygroma	**Any** subdural hemorrhage/hygroma	Unexplained subdural hematoma without history of high-energy trauma (eg, motor vehicle collision, long-distance fall)	
Visceral injury	**Any** visceral injury	**Any** visceral injury	Traumatic visceral injury unexplained by motor vehicle collision or verified history of accidental high-energy blow to the abdomen*	

In the absence of significant, independently verified trauma mechanisms like motor vehicle collisions, the listed injuries by age should prompt further evaluation for physical child abuse. Other injuries not listed may also warrant further investigation. Refer to UpToDate content on recognition of physical child abuse.

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* Proximal hollow-viscus and pancreatic injuries are more common in abuse than accidental trauma in young children and justify additional scrutiny of the given history.

Graphic 119441 Version 2.0

Red flag history for child physical abuse

■ No history or denial of trauma despite severe injury
■ Implausible history for degree or type of injury*
■ Unexplained or excessive delay in seeking care
■ Injury attributed to in-home resuscitation efforts
■ Caregiver histories that change with retelling or conflict with versions from other observers
■ Severe injury explained as self-inflicted or blamed on other young children or pets

* Examples of implausible histories include major trauma attributed to a "fall down the stairs" or other short fall, such as a fall from a sitting position, or an injury mechanism that requires the child to have capability beyond his or her developmental level (eg, severe scald burns in a 12-month-old attributed to the patient "turning on the hot water faucet").

Graphic 109401 Version 3.0

Developmental surveillance milestones: 0 to <12 months

	Social-emotional	Language/communication	Cognitive	Motor
2 months	■ Calms down when spoken to or picked up ■ Looks at your face ■ Seems happy to see you when you walk up to them ■ Smiles when you talk to or smile at them	■ Makes sounds other than crying ■ Reacts to loud sounds	■ Watches you as you move ■ Looks at a toy for several seconds	■ Holds head up when on tummy ■ Moves both arms and both legs ■ Opens hands briefly
4 months	■ Smiles on their own to get your attention ■ Chuckles when you try to make them laugh ■ Looks at you, moves, or makes sounds to get or keep your attention	■ Makes sounds like "oooo" and "aahh" (cooing) ■ Makes sounds back to you when you talk to them ■ Turns head toward the sound of your voice	■ If hungry, opens mouth when they see breast or bottle ■ Looks at their hands with interest	■ Holds head steady without support when you are holding them ■ Holds a toy when you put it in their hand ■ Uses their arm to swing at toys ■ Brings hands to mouth ■ Pushes up on elbows/forearms when on tummy
6 months	■ Knows familiar people ■ Likes to look at themselves in the mirror ■ Laughs	■ Takes turns making sounds with you ■ Blows "raspberries" (sticks out tongue and blows) ■ Makes squealing noises	■ Puts things in their mouth to explore them ■ Reaches to grab a	■ Rolls from tummy to back ■ Pushes up with straight arms when on tummy ■ Leans on hands to support

				toy they want ■ Closes lips to show they do not want more food	themselves when sitting
9 months	■ Is shy, clingy, or fearful around strangers ■ Shows several facial expressions (eg, happy, sad, angry, surprised) ■ Looks when you call their name ■ Reacts when you leave (eg, looks, reaches for you, or cries) ■ Smiles or laughs when you play peek-a-boo	■ Makes different sounds like "mamamama" and "babababa" ■ Lifts arms to be picked up		■ Looks for objects when dropped out of sight (eg, spoon, toy) ■ Bangs 2 things together	■ Gets to a sitting position by themselves ■ Sits without support ■ Uses fingers to "rake" food toward themselves ■ Moves things from 1 hand to the other hand

Adapted from: Zubler JM, Wiggins LD, Macias MM, et al. Evidence-informed milestones for developmental surveillance tools. Pediatrics 2022; 149:e2021052138.

Developmental surveillance milestones: 12 to <30 months

	Social-emotional	Language/communication	Cognitive	Motor
12 months	▪ Plays games with you (eg, pat-a-cake)	▪ Waves "bye-bye" ▪ Calls a parent "mama" or "dada" or another special name ▪ Understands "no" (pauses briefly or stops when you say it)	▪ Puts something in a container (eg, a block in a cup) ▪ Looks for things they see you hide (eg, a toy under a blanket)	▪ Pulls up to stand ▪ Walks holding onto furniture ▪ Drinks from a cup without a lid, as you hold it ▪ Picks thing up between thumb and pointer finger (eg, small bits of food)
15 months	▪ Copies other children while playing (eg, taking toys out of a container when another child does) ▪ Shows you an object that they like ▪ Claps when excited ▪ Hugs stuffed doll or other toy ▪ Shows you affection (eg, hugs, cuddles, or kisses you)	▪ Tries to say 1 or 2 words besides mama or dada (eg, "ba" for ball or "da" for dog) ▪ Looks at a familiar object when you name it ▪ Follows directions given with both a gesture and words (eg, gives you a toy when you hold out your hand and say, "Give me the toy") ▪ Points to ask for something or to get help	▪ Tries to use things the right way (eg, phone, cup, book) ▪ Stacks at least two small objects (eg, blocks)	▪ Takes a few steps on their own ▪ Uses fingers to feed themselves some food
18	▪ Moves away	▪ Tries to say ≥3 words	▪ Copies you	▪ Walks

months	from you but looks to make sure you are close by ■ Points to show you something interesting ■ Puts hands out for you to wash them ■ Looks at a few pages in a book with you ■ Helps you dress them by pushing arm through sleeve or lifting up foot	besides mama or dada ■ Follows 1-step directions without any gestures, like giving you the toy when you say, "Give it to me"	doing chores (eg, sweeping with a broom) ■ Plays with toys in a simple way (eg, pushing a toy car)	without holding onto anyone or anything ■ Scribbles ■ Drinks from a cup without a lid and may spill sometimes ■ Feeds themselves with their fingers ■ Tries to use a spoon ■ Climbs on and off a couch or chair without help
24 months	■ Notices when others are hurt or upset (eg, pausing or looking sad when someone is crying) ■ Looks at your face to see how to react in a new situation	■ Points to things in a book when you ask (eg, Where is the bear?") ■ Says at least 2 words together (eg, "More milk") ■ Points to at least 2 body parts when you ask them to show you ■ Uses more gestures than just waving and pointing (eg, blowing a kiss or nodding yes)	■ Holds something in 1 hand while using the other hand (eg, holding a container and taking the lid off) ■ Tries to use switches, knobs, or buttons on a toy ■ Plays with >1 toy at the same time (eg, putting toy food on a toy plate)	■ Kicks a ball ■ Runs ■ Walks (not climbs) up a few stairs with or without help ■ Eats with a spoon

Loop mark

Note the characteristic bruising pattern.

Courtesy of Joan E Shook, MD.

Graphic 79515 Version 2.0

Fingertip bruises

Note the oval shaped bruises on the child's trunk.

Courtesy of Joan E Shook, MD.

Graphic 52863 Version 2.0

Fingertip bruises

Note the oval shaped bruises on the child's upper arm and forearm.

Courtesy of Joan E Shook, MD.

Graphic 61566 Version 2.0

Belt mark

Note the broad bands of ecchymosis that end in a buckle-shaped bruise.

Courtesy of Joan E Shook, MD.

Graphic 68419 Version 2.0

Immersion burn

Note the sharp demarcation between the burn and normal skin and the absence of drip or splash marks, as well as the characteristic distribution on the buttocks and lower legs. Sparing of the thicker skin of palms or soles, and of skin folds where knees and hips are flexed, is also a common finding.

Graphic 58030 Version 5.0

Immersion scald burn due to child abuse

Note the sharp line of demarcation of the burn ("high water mark") on the leg and the extensive, deep, second-degree burns of the buttocks.

Graphic 109270 Version 3.0

Stocking immersion

This pattern of deep symmetrical burns in a stocking distribution is typical for inflicted immersion injury.

Reproduced with permission from Stephen Ludwig, MD.

Graphic 78135 Version 1.0

Brand burn

Note the imprint in the shape of a clothes iron.

Graphic 60768 Version 2.0

Burn depth

Depth	Cause	Appearance	Sensation	Healing time
Superficial (epidermal)	Ultraviolet exposure (eg, sunburn) Very short flash	Dry, red Blanches with pressure	Painful	3 to 6 days
Superficial partial-thickness	Scald (spill or splash) Short flash	Blisters Moist, red, weeping Blanches with pressure	Painful to temperature and air	7 to 20 days
Deep partial-thickness	Scald (spill) Flame Oil Grease	Blisters (easily unroofed) Wet or waxy dry Variable color (patchy to cheesy white to red) Does not blanch with pressure	Painful, perceptive of pressure	>21 days
Full-thickness	Scald (immersion) Flame Steam Oil Grease Chemical Electrical	Waxy white to leathery gray to charred and black Dry and inelastic No blanching with pressure	Deep pressure only	Never (if >2% total body surface area)

Adapted from:

1. *Mertens DM, Jenkins ME, Warden GD. Out patient burn management. Nurs Clin North Am 1997; 32:343.*
2. *Peate WF. Outpatient management of burns. Am Fam Physician 1992; 45:1321.*
3. *Clayton MC, Solem LD. No ice, no butter. Advice on management of burns for primary care physicians. Postgrad Med 1995; 97:151.*

Modified Lund-Browder chart

Adult

Child (age 5)

Infant
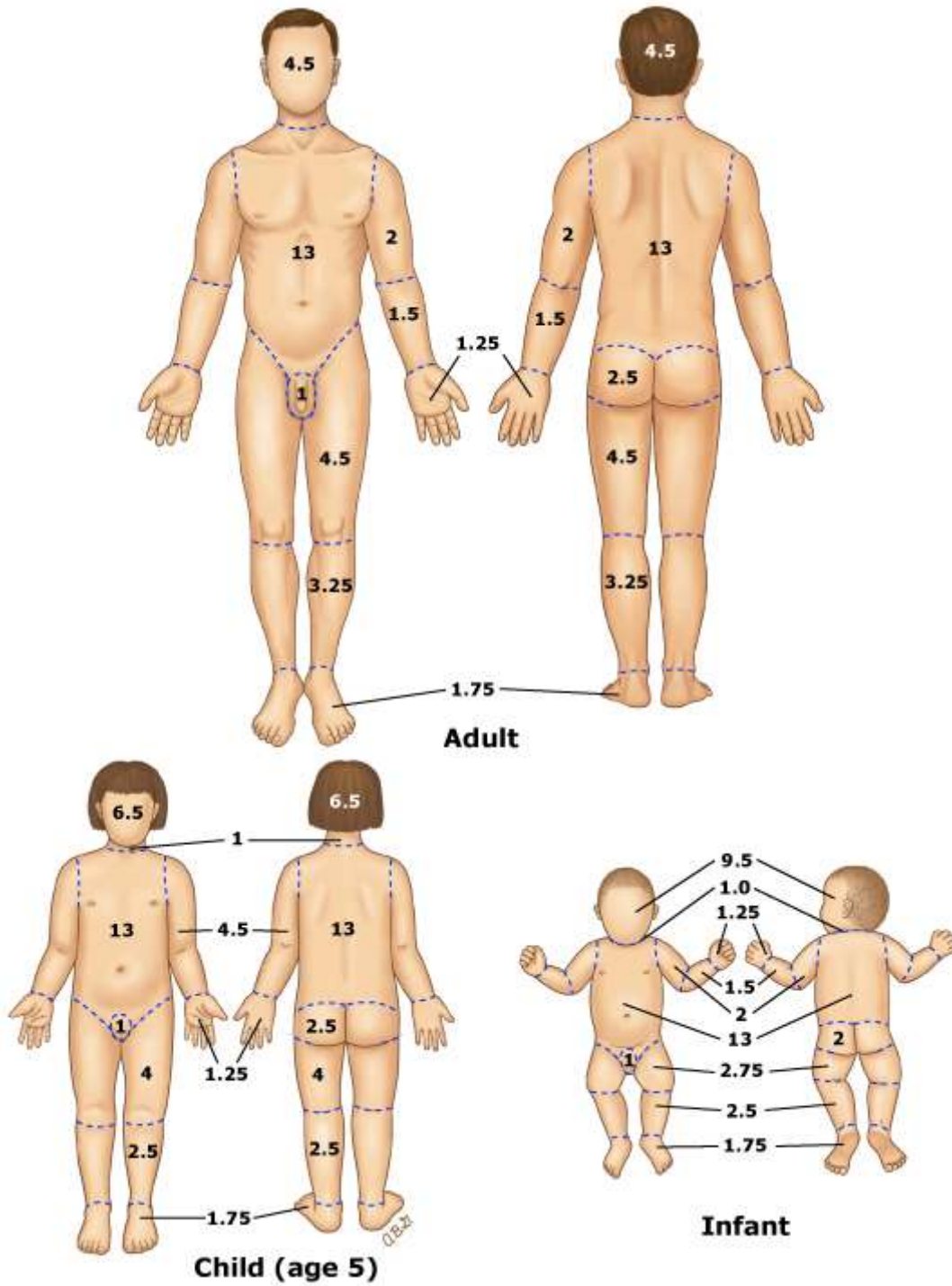
Numbers refer to the percentage body surface area burned.

The standard skeletal survey

Appendicular skeleton
Humeri (AP)
Forearms (AP)
Hands (PA)
Femurs (AP)
Lower legs (AP)
Feet (AP)
Axial skeleton
Thorax (AP, lateral, right and left oblique views) to include the ribs, thoracic spine, and upper lumbar spine
Ribs (oblique views)
Abdomen (AP, to include the pelvis)
Lumbosacral spine (lateral)
Skull (frontal and lateral)*
Cervical spine (lateral [if not completely visualized on lateral skull])
Technique
High resolution
High contrast

AP: anteroposterior; PA: posteroanterior.

*Omit skull radiographs if the child will undergo computed tomography of the head with three-dimensional reconstruction.

Adapted from:
1. *Section on Radiology; American Academy of Pediatrics. Diagnostic imaging of child abuse. Pediatrics 2009; 123:1430.*
2. *The American College of Radiology. ACR appropriateness criteria. Suspected physical abuse - child. Available at the following* link.

Graphic 82510 Version 12.0

Indications for obtaining a skeletal survey

- All children <2 years with obvious abusive injuries

- All children <2 years with any suspicious injury, including:
  - Bruises or other skin injuries in nonambulatory infants;
  - Oral injuries in nonambulatory infants; and
  - Injuries not consistent with the history provided

- Infants with unexplained, unexpected sudden death (consult with medical examiner/coroner first)

- Infants and young toddlers with unexplained intracranial injuries, including hemorrhage and hypoxic-ischemic injury

- Infants and siblings <2 years and household contacts of an abused child

- Twins of abused infants and toddlers

Classic metaphyseal fracture of child abuse (metaphyseal corner or bucket handle fracture)

Metaphyseal corner fracture of the distal femur (arrows). This classic metaphyseal lesion occurs when the extremity is pulled or twisted, or the child is shaken. The resultant shearing force undercuts an isolated fragment of the metaphysis that includes the subperiosteal bone collar. When viewed tangentially, the lesion appears as a triangular fragment of the metaphysis (ie, the "corner" fracture).

Courtesy of Susan A Scherl, MD.

Graphic 79186 Version 5.0

Bilateral metaphyseal bucket handle fractures of the distal tibia

This 3-month-old child with bilateral ankle swelling was found to have bilateral metaphyseal "bucket-handle" type fractures (arrows).

Courtesy of Eglal Shalaby-Rana, MD.
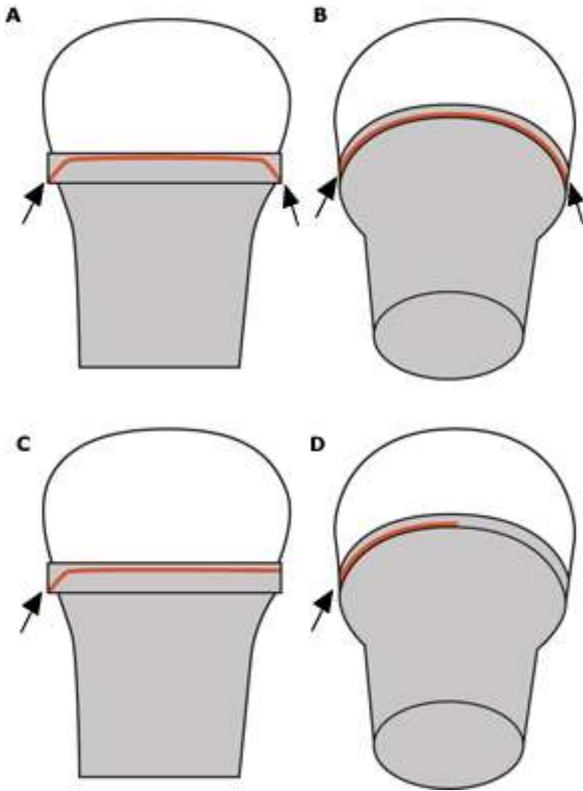
Graphic 82390 Version 5.0

Bucket handle fracture

This radiograph demonstrates a distal tibial metaphyseal fracture with a "bucket handle" appearance highly suggestive of child abuse.

Courtesy of Mark C Clark, MD, FAAEM, FAAP, FACEP.

Graphic 130664 Version 1.0

Metaphyseal lesions

Diagrammatic representation of the relationship of the subperiosteal bone collar to a metaphyseal lesion.

(A) A tangential view of the metaphyseal margin, demonstrating a fracture line that extends adjacent to the chondro-osseous junction centrally. Peripherally, the fracture line (arrows) veers away from the growth plate to undermine a larger peripheral fragment, incorporating the subperiosteal bone collar (corner fracture).

(B) When the fracture line (arrows) is projected obliquely, the thicker peripheral fragment, including the subperiosteal bone collar, is projected as a curvilinear fragment or a bucket-handle lesion.

(C) When the fracture line (arrow) is incomplete (it extends across only a portion of the metaphysis), the appearance suggests a focal, triangularly shaped peripheral fragment encompassing the subperiosteal bone collar (corner fracture).

(D) When the fracture line (arrow) is tipped obliquely, the peripheral margin of the fragment is projected as curvilinear density (bucket handle fracture).

Multiple posterior rib fractures
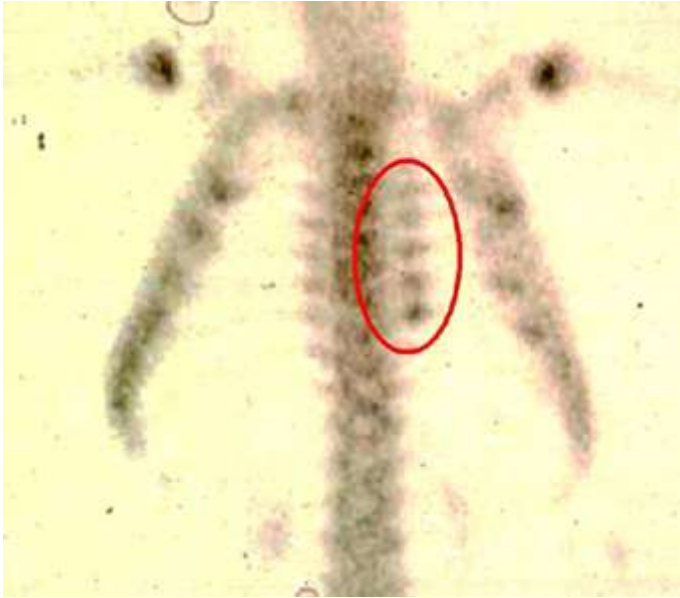
Bone scan showing multiple posterior rib fractures. Rib fractures are highly suggestive of child abuse. Inflicted rib fractures usually are non-displaced and involve multiple sequential ribs (corresponding to the abuser's fingers).

Courtesy of Susan A Scherl, MD.

Graphic 73993 Version 4.0

Multiple fractures

A 2-month-old with multiple fractures in various stages of healing (acute distal humerus lateral condyle fracture and old segmental fracture of the radius). Multiple fractures, old or in various stages of healing, are highly suggestive of child abuse.

Courtesy of Susan A Scherl, MD.

Graphic 73313 Version 3.0

Child abuse emergency department screening tool

1. Is the history consistent?	Yes	No
2. Was seeking medical help unnecessarily delayed?	Yes	No
3. Does the onset of the injury fit with the developmental level of the child?	Yes/NA	No
4. Is the behavior of the child, his or hers carers, and their interaction appropriate?	Yes	No
5. Are findings of the head-to-toe examination in accordance with the history?	Yes	No
6. Are there other signals that make you doubt the safety of the child or other family members?	Yes*	No
Other comments		

The screening instrument for child abuse used at the emergency departments. One (or more) ticked answers in the dark boxes indicate the possibility of an increased risk of child abuse and further action is recommended.

N/A: not applicable.

* If "Yes," describe the signals in the box "Other comments".

Reproduced from: Louwers E, Korfage IJ, Affourtit MJ, et al. Accuracy of a screening instrument to identify potential child abuse in emergency departments. Child Abuse Negl 2014:1275. Table used with the permission of Elsevier Inc. All rights reserved.

Diagnostic evaluation for suspected physical child abuse

Patient characteristic	Order/action
INITIAL EMERGENCY EVALUATION	
■ All patients	**Report to child protective services (where applicable)**
	Consult (directly contact consultant): ■ Social work ■ Child abuse specialist/team ■ Trauma surgery
■ Infant <6 months old, regardless of physical findings ■ Infant 6 to <12 months old with external head injuries on examination OR skull fracture OR fracture highly suggest of abuse (eg, rib fractures or metaphyseal fractures) ■ Child of any age with signs suggesting intracranial injury	**Perform neuroimaging:** ■ Head CT*
■ All children <2 years old ■ Child <5 years old AND (neurologically impaired OR distracting injury OR suspicious index fracture)	**Perform skeletal survey radiographs**
■ Infant <6 months of age ■ Older child with trunk bruising or significant injury (eg, fracture, intracranial hemorrhage)	**Screen for abdominal injury:** ■ AST ■ ALT ■ Lipase **AST OR ALT >80; lipase >100:** ■ CT abdomen with intravenous contrast (no oral contrast)
■ Child with bruising or bleeding¶	**Screen for bleeding disorder:**Δ ■ CBC with platelets ■ PT, INR, aPTT ■ VWF antigen ■ VWF activity ■ Factor VIII level ■ Factor IX level

	- Factor XIII level (if intracranial bleeding) - D-dimer (if intracranial bleeding) - Fibrinogen (if intracranial bleeding)

FURTHER EVALUATION

- Child with intracranial bleeding	**Screen for metabolic disease:** - Urine organic acids - Plasma amino acids
- Child with suspected abusive head trauma, periorbital bruising, or eye injury	**Identify retinal hemorrhages:** - Ophthalmology consult within 72 hours[◊]
- Child with concern for abuse due to fracture(s)[¶]	**Screen for metabolic bone disease:**[§] - Serum calcium and phosphorus - Serum alkaline phosphatase - Intact parathyroid hormone level - 25-OH vitamin D level **When osteogenesis imperfecta is suspected:**[§¥] - COL 1A1, COL 1A2, IFITM5 gene sequence
- Male infant <6 months old with fracture[¶]	**Screen for Menkes disease:**[¥] - Serum copper level - Serum ceruloplasmin level
- Child with symptomatic neurologic injury	**Evaluate for cervical spine soft tissue and additional brain injury:** - At 2 days, MRI of cervical spine and brain
- All children with continued suspicion of physical child abuse after the initial evaluation	**Evaluate for healing initially undiagnosed fractures:** - At 2 weeks, repeat skeletal survey radiographs; omit skull, lateral spine, and pelvis views

This table provides suggested studies to evaluate for child physical abuse based upon patient age and specific type of injury. Consultation with a child abuse team led by a child abuse specialist is encouraged to guide testing in specific patients. For more detailed information, refer to UpToDate content on the recognition and diagnosis of physical child abuse. This table does **not** apply to the evaluation of child neglect or sexual abuse.

CT: computed tomography; AST: aspartate transaminase; ALT: alanine transaminase; CBC: complete blood count; PT: prothrombin time; INR: international normalized ratio; aPTT: activated partial

thromboplastin time; VWF: von Willebrand factor; MRI: magnetic resonance imaging.

* Brain MRI instead of head CT is acceptable for initial neuroimaging of asymptomatic children when MRI and pediatric neuroradiologist interpretation are readily available within a few hours.

¶ While some child abuse specialists will recommend these studies in all cases, it may be reasonable to omit them when the diagnosis of abuse is more secure due to witnessed abuse, confessed abuse, skin injuries with the imprint of an object or hand, or multiple injuries not explainable by a single medical condition.

Δ For patients with abnormal testing results, or if further testing is desired, consult a pediatric hematologist.

◇ Examination within 48 hours is preferred, when possible.

§ Consult a pediatric endocrinologist for patients with abnormal testing results.

¥ Consult a geneticist to interpret results in light of the patient's phenotype.
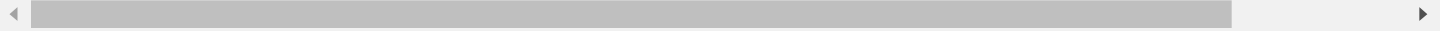
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