

# Physical Abuse of Children

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**Objectives** After completing this article, readers should be able to:

1. Recognize the 10 commonly identified history elements and risk factors in the presentation of child abuse.
2. Identify the soft-tissue and skeletal injuries that are indicative of physical abuse.
3. Understand the complexity of the presentation of abusive head trauma and the key diagnostic findings.
4. Review the mandated child abuse reporting requirements for medical professionals.
5. Discuss the physician's role as child advocate in both the identification and the prevention of child abuse.

## Introduction

Since the last *Pediatrics in Review* update of physical abuse of children in 1994, information in the field has exploded. Data regarding diagnosis and treatment of physical abuse, neglect, and sexual abuse of children is more readily available to health care clinicians than ever before through peer review articles, written texts, picture atlases, internet resources, and American Academy of Pediatrics (AAP) educational materials. It is, however, even more difficult for the busy practitioner to evaluate suspected child abuse.

## Epidemiology and Statistics

According to the federal publication *Child Maltreatment 2002*, the rate of childhood victimization was 12.3 per 1,000 in 2002 compared with a rate of 12.4 per 1,000 in 2001. Of nearly 3 million referrals to child protection agencies in 2002, 67.1% were assigned to workers for investigation. Of these assigned investigations, fewer than one third (26.8%) were "substantiated" or "founded" as child maltreatment, reflecting an estimated 896,000 victims. During 2002, 58.5% of victims suffered neglect, 18.6% were physically abused, 9.9% were sexually abused, and 6.5% were emotionally or psychologically maltreated. Children who suffered more than one form of abuse were more likely to be recurrent victims. Children who had been victimized in a prior year also were more likely to experience a recurrence of founded abuse. Children from birth to age 3 years had the highest rates of childhood victimization, and more than 80% of all victims were maltreated by one or both parents.

Child abuse fatalities are underreported largely due to underrecognition, differences in state reporting laws, and lack of standard terminology and death investigation procedures. In 2002, an estimated 1,400 infants and children were reported to have died from abuse and neglect. Children younger than 1 year of age accounted for 41.2% of fatalities, and 83% of all fatalities occurred in those younger than 4 years of age. Maltreatment deaths were associated more often with neglect (37.6%) than with any other type of abuse.

## Exposure to Violence and the Role of the Primary Care Physician

The importance of identification and prevention of family and youth violence has been emphasized in the past decade. According to the National Violence Against Women

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Survey conducted in 1996, abuse of partners and children coexists in 30% to 60% of violent homes. Nearly 1.5 million women and 834,000 men reported being sexually or physically assaulted by an intimate partner. The *Juvenile Justice Bulletin* of May 2000 reported that juveniles were twice as likely as adults to be victims of violent crimes and three times as likely to be the victims of sexual assault. Juveniles are more likely to know their offenders and less likely to report violent crimes to the police.

The long-term effects of chronic exposure to domestic violence and child abuse may affect a child's overall development. Social, cognitive, and emotional development may be adversely affected. Child victims function overall at levels below their peers, are more likely to experience mental illness (depression, suicide, somatic disorders, eating disorders, poor peer relations, learned aggression, posttraumatic stress disorder), and may suffer repeated victimization. Children exposed to abuse, neglect, and violence are at increased risk of becoming offenders themselves and are more likely to live in poverty and to face homelessness.

Injury from violence is a problem that is being confronted in large numbers of pediatric practices. Screening families for domestic violence often can be the first clue to a child's victimization. The AAP Task Force on Violence recommends routinely assessing for domestic violence from infancy through late adolescence. This indicates to the patient that pediatricians recognize domestic violence as a health care concern and are willing to talk about it.

Primary care clinicians are faced with signs and symptoms of childhood injury every day. The recognition of child physical abuse begins with acknowledgment by the clinician that child abuse occurs commonly; that abuse can occur in families from any socioeconomic class, ethnicity, or community; and that abuse must be considered in the differential diagnosis of all childhood trauma. A clinician should evaluate the child and family without bias for risk factors highly associated with child abuse. Honesty and straightforwardness can be balanced with objectivity and empathy. It is stressful for a physician to approach such an evaluation, and it is recognized that the situation is similarly stressful for the family. The risk of family stress must be weighed against the risk of not identifying physical abuse properly.

## History

### General Child Abuse History

Pediatricians must be sufficiently skilled to obtain the necessary history from the caregiver and the child. The

### Table 1. Common Child Abuse History Risk Factors

- Injury that is unexplained by history or developmentally not possible
- Absent, changing, or evolving history
- Delay in seeking care
- Inappropriate affect of the caregiver
- Triggering event that precipitates a loss of control in the caregiver
- Unrealistic expectations of the caregiver for the infant or child
- Crisis or stress in the family or the caregiver
- Social or physical isolation of the family or the caregiver
- Pattern of increasing severity or escalation of number of events over time
- Prior history of abuse in the childhood of the caregiver

“abusive pattern” remains a useful model to understand how child abuse occurs. The sociocultural factors (eg, employment, poverty, religious or cultural beliefs about discipline, history of previous abuse) of a family unit, in conjunction with external or internal stressors (eg, multiple births, poverty, isolation, family discord, substance abuse, mental illness, violence), often combined with special aspects of the child (eg, developmental delay, acute or chronic illness, behaviors) and a triggering event (crying, colic, toilet accidents, parent-child conflict, temperament, and behaviors) can lead to physical abuse.

### Trauma History

The most commonly recognized risk factors identified in a child abuse trauma history are listed in Table 1.

Information regarding the present illness or injury should be documented clearly. Documentation of the initial history may help physicians and subsequent consultants to identify an evolving or changing history. In cases suspicious for child abuse, caretakers often have either no answer or an unreasonable answer to the routinely asked questions such as, “Can you tell us what happened?” or “How was your child injured?” Answers that demonstrate a lack of prudent parenting or decision-making are a red flag (eg, “I only left him in the tub for a few minutes”; “I always hit him with a belt when he’s not listening to me”).

Witnessed trauma and the mechanism of injury should be described with as much detail as possible (eg, fall from what height? impact onto what type of surface? how was the child acting after the injury?). Older tod-

dlers and children should be asked directly about the nature of the injury and, if possible, asked separately from the caregiver. Language barriers should be addressed by using a translator who is not a family caregiver, if possible.

Other questions may help to determine the events that preceded the injury (triggering event), timing of the injury, caretaker's response (delay in seeking care), when the infant or child last fed and last acted normally, individuals who had access to the child, and whether other children were present who may have observed events and can provide details. It is important to remember that siblings or other children (or other adults) who were present when the child was injured also may be at risk of harm.

### Past Medical History

Details should be reviewed to identify previous trauma, injury, or chronic illness. Documentation of birth trauma and administration of vitamin K at birth are important questions regarding any young infant who has intracranial hemorrhage.

Many diseases present with signs or symptoms that could mimic physical abuse (eg, fractures in a child who has osteopenia; bruising in a child who has von Willebrand disease; seizures, intracranial hemorrhage, and periosteal reactions or metaphyseal irregularities in Menke disease). It is important to remember that children who have chronic illness or disease may be at increased risk for maltreatment due to increased care needs, behaviors of the child, and family stress. It is even more important to emphasize that children who have such metabolic, genetic, or other disorders also can have physical abuse as a comorbid diagnosis.

The developmental history should document the infant's or child's present level of functioning and any delays because those who have delays are at increased risk for abuse and neglect.

Family history also should include questions regarding bleeding disorders, collagen vascular disease, easy bruising, easily fractured bones or poorly healed fractures, dental and hearing abnormalities, and routine common diseases. A history of recurrent infant deaths might represent sudden infant death syndrome, undiagnosed metabolic disease, or infanticide. A history of "small children" might be a red flag for child neglect and "nonorganic failure to thrive."

Social history should detail the family environment, parenting skills, and discipline practices. Psychological maltreatment of children should be considered when unhealthy parenting practices or psychologically aggres-

sive behaviors are identified. This form of maltreatment has been reviewed in a very helpful AAP technical report. (1) Questions regarding substance or alcohol abuse, mental illness, domestic violence, family planning, recent crisis or stressors, prior criminal or child protection agency involvement, and parent's victimization are difficult to ask, but they provide vital insight about the family dynamics and level of functioning.

## Physical Examination

### General

A thorough physical examination is necessary to complete the forensic medical evaluation for children suspected of being physically abused or neglected. As in all pediatric examinations, growth parameters (height, weight, and head circumference) must be measured and plotted. "Nonorganic failure to thrive" often can be a manifestation of nutritional and physical neglect seen in a non-nurturing home environment or with a mother who has poor bonding and attachment to her infant or postpartum depression. Rapid increases in head circumference over a short period of time might indicate subacute or chronic subdural hematomas in an abused infant.

### The Head and Neck

The head and scalp should be examined for swelling, abrasions, lacerations, hematomas, and ecchymoses. During the examination of the anterior fontanelle and the sutures, presence of any "step-off" suggesting a depressed skull fracture should be noted. A full, tense, or bulging anterior fontanelle is evidence of intracranial pathology.

Infants who present with head injury and retinal hemorrhage often cannot track objects. Undilated funduscopic examination sometimes can document evidence of retinal hemorrhage and should be a part of all forensic evaluations. Further pediatric ophthalmology consultation is required for infants who have abnormal funduscopic examination results and for all infants who have intracranial hemorrhage. Although their pathophysiology currently is being studied, the presence of retinal hemorrhages in the clinical picture of head trauma in a young child or infant is highly correlated with physical abuse.

Forceful feeding or attempts to silence a crying infant by using a hand or object such as a bottle or utensils can cause bleeding and oral trauma. Complete examination of the oropharynx should look at the frenula, gingiva, hard and soft palates, tongue, sublingual regions, buccal mucosa, and posterior pharynx for any sign of trauma. Blind sweeping of the posterior pharynx by inexperi-

enced caregivers can cause significant trauma. Forced caustic ingestions and foreign body aspirations can be overlooked forms of abuse that also can lead to perforations of the esophagus and hypopharynx with potentially lethal injury.

Oral and dental aspects of child abuse and neglect are well described in an AAP statement. (2) In addition to trauma to the oral cavity, tongue, palate, and frenula, blunt trauma to teeth and fractures of facial bones and jaw all can result from intentional trauma. Dental neglect evidenced by severe decay or disease should be noted.

The nose is not a common site for accidental injury until a child is mobile. Both young and older children can have nasal trauma or fracture from assault. The ears frequently are the site of intentional injury (eg, pinch, slap, boxing trauma). Chronic trauma can lead to deformed pinnae and sensorineural hearing deficit. Tympanic membranes should be examined for hemotympanum or otorrhea, and the pinnae and posterior auricular regions should be examined for trauma. Injuries identified in these areas are very unlikely to be accidental. The “tin ear syndrome” describes bruising of the ear in association with ipsilateral subdural hemorrhage and retinal hemorrhage. The soft tissues of the neck should be palpated and inspected for evidence of injury. Ligature marks from strangulation may be seen.

### Skin: Bruises, Bites, and Burns

A recent AAP policy statement outlined the challenges facing pediatricians in determining when inflicted skin injuries constitute child abuse. (3) It noted major shifts in societal attitudes regarding which acts constitute child abuse or physical discipline. These attitudes often reflect religious beliefs, social legislation, and judicial decisions that can complicate further the role of pediatricians who must report child abuse.

It must be emphasized, however, that external signs of physical abuse, such as abrasions, bruises (Fig. 1), bite marks, pinch marks, ligature marks, burns, and various pattern injuries caused by objects, are identified in more than 90% of suspected abused and neglected children. Minor injuries may represent a pattern of ongoing abuse and may lead to escalation of injury with serious morbidity and mortality.

Documenting the number, size, color, pattern, and location of physical findings is critical. Caution should be used in dating bruises. It is not possible to determine the precise age of bruises based solely on color because the development of bruise color varies, depending on location, injury depth, skin color, and chronic injury. At best, an estimate in days based on color change is more objec-



**Figure 1.** Extensive bruising on the back of a 10-month-old child, who also had multiple other new and older bruises on the face and extremities. Coagulation disorder was ruled out by laboratory screening, and the child had parietal skull and healing rib fractures. The child was removed from the parents, who had their own history of physical and current domestic violence.

tive, noting that bruises are considered older if they are yellow, brown, or green. Quality photographs are very useful in providing a visual record. Extremities and digits must be examined and findings such as grab marks documented clearly. Skin lesions, such as Mongolian spots, and dermatologic conditions such as eczema, urticaria pigmentosa, and other congenital lesions, should be identified and documented to avoid misidentification. Similarly, bruises from accidental play often can be distinguished according to location (shins and elbows) and age of the child. Bruises in an infant or developmentally less mobile child warrant investigation. Cultural healing practices such as “coining” and “cupping” that leave skin markings have been well described in various child abuse picture atlases. (4)

Bites often have elliptical or ovoid patterns and central ecchymosis. Animal bites, in contrast, leave puncture marks or torn flesh. Bite marks that have an intercanine distance of greater than 2.5 cm are likely to have been





**Figure 2.** The glove distribution burn to the hands of this 1-year-old child is a classic example of a forced immersion child abuse injury. Reprinted with permission from Sirotnak P, Krugman RD. Physical abuse of children: an update. *Pediatr Rev.* 1994;15:394–399.

inflicted by an adult. A forensic odontologist can be consulted to evaluate bite injuries or photographs of injuries. Finally, blood group substance can be secreted in saliva, and DNA present in mouth epithelial cells can be deposited during bites. The clinician should swab the area with a cotton swab moistened with distilled water and, after it dries, place the swab in a tube or envelope for forensic laboratory analysis. Chain-of-evidence procedures, as in sexual abuse forensic collection, must be followed.

Burns often are inflicted as a means of discipline or in anger, frequently in response to a toileting accident. The pattern of the burn frequently is that of immersion, involving the perineum or the extremities, with well-demarcated borders. The immersion pattern of the feet and hands has been described as “stocking” and “glove,” respectively (Fig. 2). Patterns that indicate “pouring” or “flowing” of a hot medium over the skin or “splash” marks are more characteristic of accidental injury, although a careful history is required to rule out intentional burn injury (throwing hot liquid at a child) or injuries resulting from supervisory neglect of an infant or child. All burn evaluations must include a history that details the supervision and care, developmental stage of the child, and burn prevention counseling. Agencies receiving reports of physical abuse burns need to make home visits and measure water temperatures.

Chemical burns from contact or ingestion that occur when an unattended child gains access to caustic household solutions should be evaluated for neglect as well.

## Table 2. Child Abuse Medical Emergencies

- Any infant or child younger than 2 years of age who has a history of or suspicion of shaking, blunt force, or other mechanisms of inflicted head trauma
- Any infant who has bruises (especially head, face, neck, or abdomen) or fractures or burns
- Any child who has suspected inflicted or any suspicious trauma to the abdomen, even in the absence of bruising
- Any child who has genital, stocking, or glove pattern burns; branding patterns; or extensive burns, especially if injury was unwitnessed
- Any child in whom sexual assault within the past 48 to 72 hours is disclosed

Contact burns can have varied patterns (eg, curling iron, clothes iron, cigarette) and may be accidental, although a careful history must evaluate for risk factors for abuse or supervisory neglect.

Staphylococcal or bullous impetigo, staphylococcal scalded skin syndrome, herpes, contact dermatitis, and toxic epidermal necrolysis are a few conditions that can mimic burns.

### Chest, Abdomen, and Genitalia

Bruises of the chest and abdomen on any infant or nonambulatory child should be considered a medical emergency that warrants immediate attention (Table 2). Children who sustain intentional blunt abdominal trauma are at increased risk of morbidity and mortality compared with those who sustain unintentional abdominal trauma. This increased risk is due to delay in seeking care and often false histories of no trauma or of minor illness given by caretakers at the time of presentation. Insidious, vague symptoms can be mistaken for minor illness. Histories of accidents causing such severe trauma (eg, motor vehicle accidents, high-impact falls, blunt injuries from playing sports) usually are self-evident, and delay in seeking care is less likely.

The anterior, posterior, and lateral trunk should be examined for traumatic injuries. Unequal or absent breath sounds warrant investigation for pneumothorax or hemothorax. Costochondral tenderness or chest deformity should raise the suspicion for potential lung or visceral damage from rib fracture. Palpation and inspection of the chest wall occasionally can identify callus associated with healing rib fractures. Bruises of the chest and abdomen without adequate explanation should raise

suspicion for underlying blunt injury to the thorax and abdomen, although thoracic trauma is not as common as abdominal trauma in abused children.

Injuries to the abdomen usually present insidiously with nonspecific complaints of abdominal pain, vomiting, or change in activity level and may be misinterpreted as minor gastrointestinal disease processes or appendicitis. However, they also may present with multisystem trauma (eg, head or skeletal) in a severely compromised child. Positive laboratory results may include anemia, hematuria, and elevated amylase, lipase, and liver function tests.

The most common intentional injuries to the abdomen involve the liver and spleen, followed by duodenal or jejunal rupture or hematomas and pancreatic, vena cava, and renal trauma. These injuries often are caused by compression of the viscera against the vertebral column by a direct blow to the abdomen. Children have relatively large adrenal glands that can be injured as a result of compressive forces to the thorax and abdomen. Retroperitoneal hemorrhage or secondary peritonitis can be lethal.

Given the high morbidity and mortality of physical abuse abdominal injuries, evaluation by the most experienced pediatric surgeon or trauma center of any child who has suspected abdominal or thoracic trauma is recommended.

Examination of the genitalia and the anus should be part of the evaluation of a physically abused child. Bruising, abrasion, laceration, or major tearing of genital or anal structures may be the result of either physical or sexual assault. If the history or examination findings are highly suggestive of sexual assault, especially if body fluid may have been transmitted, forensic evidence should be collected. Questions regarding abnormal findings can be referred to specialists trained in the forensic evaluation of suspected victims of sexual abuse. Several atlases that contain examples of normal and abnormal examination results are excellent quick resources for the practitioner. (5)(6)

### Skeletal Trauma

A forensic medical evaluation for suspected physical abuse in an infant, a child younger than 2 years of age, or an otherwise nonverbal child is not complete without a skeletal survey to look for signs of acute or healing skeletal injury. Radiographs should not replace either a detailed history (including questions regarding height of fall, contact surface, witness to injury) or the physical examination (which can identify soft-tissue edema, limited use or range of motion of a joint or extremity, or a

### Table 3. Complete Skeletal Radiographic Series for Physical Abuse

- Anteroposterior and lateral skull
- Lateral cervical spine
- Anteroposterior, lateral, and oblique ribs
- Anteroposterior pelvis
- Lateral thoracic–Lumbar spine
- Anteroposterior humeri, forearms, femurs, tibias, and fibulas
- Oblique hands
- Anteroposterior feet

deformity suggestive of underlying skeletal trauma). Certain mechanisms of injury may result in specific fractures. Twisting or torsion may result in spiral fractures of extremities; whole traction forces from pulling on limbs may cause classic metaphyseal fractures.

Skeletal surveys should follow the protocol outlined in Table 3. Radionuclide bone scans can reveal subtle areas of skeletal trauma that might not be seen on plain films. Bone scans should be considered a complementary procedure to plain film radiography because the two modalities have not yet been compared prospectively. Lower specificity than skeletal surveys, higher cost, limited availability, and a greater dependency on both technique and interpretation can limit their usefulness. Repeating limited views 2 weeks after the initial survey to reevaluate areas of concern, such as possible acute rib fractures that might be difficult to see in young infants, can be very helpful.

Pediatric radiologists are valuable consultants who can assist in dating fractures, expanding and excluding differential diagnoses, recommending specific additional imaging modalities, and verifying potential mechanisms of injury.

Certain fractures in a child carry a higher specificity for abuse than others (Fig. 3). Kleinman has described fractures as having a high, moderate, and low specificity of abuse (Table 4). In any pediatric fracture, a detailed medical history is critical to attempt to determine intentional versus nonintentional trauma as well as to assess for any other disease or condition.

Other diseases or conditions can be mistaken for intentional injury, but their identification does not necessarily exclude a comorbid diagnosis of physical abuse. Occurring in only 1 in 20,000 births, osteogenesis imperfecta (OI), a disorder of collagen synthesis affecting bone and connective tissue, often is suspected in infants and

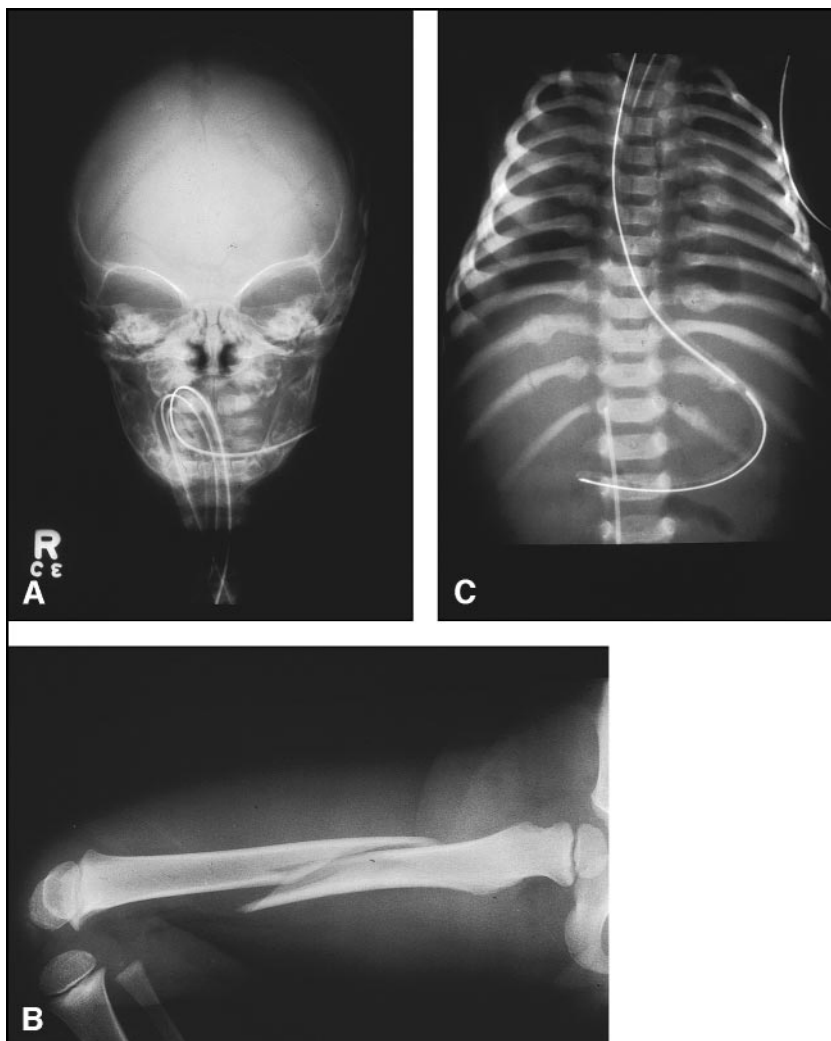
children who present with fractures in various stages of healing. Culture of biopsied fibroblasts is not 100% sensitive and specific, and the genetic enzyme defect analysis is not readily available and is expensive. Taking a careful history and referring to a geneticist and pediatric orthopedic surgeon are most helpful in confirming or excluding the diagnosis of OI.

Other diseases simulating abuse include Menke syndrome, various skeletal dysplasias, rickets, congenital syphilis, hypophosphatasia, osteoid osteoma, infant cortical hyperostosis, and leukemia. Some normal variants of bone mistaken for abuse include nutrient canals, cortical irregularities, metaphyseal beaks and spurs, distal ulnar cupping, normal symmetric peritoneal changes seen in infants, and ossification defects of the ribs. A careful medical history can exclude many of these normal conditions and diseases. Pediatric radiologists always should be consulted to ensure a correct diagnosis and to recommend further radiographic evaluation.

## Abusive Head Trauma

### Epidemiology

Abusive head trauma (shaken baby syndrome [SBS], shaken impact syndrome) may be the most highly publicized form of child physical abuse because of many high-profile and controversial cases in recent years. SBS is a clearly definable medical condition. There is a solid foundation in the medical literature of the past 3 decades that has continued to describe, characterize, and study the epidemiology and incidence of both intentional and nonintentional pediatric head trauma; the biomechanics of head injury; the presenting signs, symptoms, and radiologic findings; and outcomes of this devastating form of physical abuse. The role of the primary care physician includes identification of abusive head trauma, referral to trauma care specialists, provision of ongoing primary medical care, advocacy for the children who have subsequent special needs, and, of course, primary prevention.



**Figure 3.** Examples of fractures that are highly specific for child abuse. A. Diastatic, bilateral parietal and occipital skull fractures in a 3-month-old caused by a caregiver throwing the infant to floor. B. Spiral femur fracture with absent trauma history in a nonambulatory child. C. Multiple anterolateral and posterior rib fractures in a 2-month-old who died from inflicted head trauma. Squeezing blunt chest trauma caused pulmonary contusions. Liver, adrenal, and small bowel injury confirmed blunt abdominal trauma as well.

SBS is a serious form of physical abuse that most often involves children younger than 2 years and has the highest mortality of all forms of physical abuse. The injuries seen in SBS are not seen following short falls, seizures, or immunizations. The serious head injuries of SBS rarely are accidental unless there is a clear explanation, such as motor vehicle trauma. Studies have showed that 95% of all serious intracranial injuries and 64% of all head injuries in infants younger than 1 year of age are due to physical abuse. Up to 80% of deaths from head trauma in one series were a result of abuse.

**Table 4. Specificity of Fractures for Physical Abuse**

High Specificity

- Metaphyseal chip fractures
- Bucket handle fractures
- Rib fractures, especially posterior location
- Scapular fractures
- Spinous process
- Sternum

Moderate Specificity

- Multiple or bilateral fractures
- Fractures of different ages
- Epiphyseal separations
- Vertebral body fractures and subluxations
- Digital fractures
- Complex or multiple skull fractures

Common But Low Specificity

- Subperiosteal new bone formation
- Clavicle fractures
- Long bone shaft fractures
- Linear, simple skull fractures

Excluding falls resulting in epidural hemorrhage, accidental impacts rarely cause severe or fatal intracranial injury in infants. Child abuse should be suspected when serious head injury allegedly has resulted from either unwitnessed or short falls from beds, cribs, couches, changing tables, and toilet seats. The presence of any of the historical risk factors for abuse or neglect (Table 1) should heighten the degree of suspicion. The presence of intracranial hemorrhage in an infant or young child is highly correlated with physical abuse, but a broad differential diagnosis can be excluded with use of a detailed medical history, laboratory tests, and imaging (Table 5).

### Pathology

Subdural hemorrhage results from disruption of the bridging veins caused by acceleration-deceleration forces from shaking. The hemorrhage may be unilateral, bilateral, over the convexities, or interhemispheric and may accompany subarachnoid hemorrhage. Cerebral contusions are infrequent, but they may be seen with impact trauma. Diffuse axonal injury is common. The secondary brain injury of isolated or global hypoxic-ischemic damage may cause focal or global cerebral edema and infarction. Later findings of atrophy with volume loss, enlarged ventricles, encephalomalacia, and chronic subdural hemorrhages are common (Fig. 4).

**Table 5. Differential Diagnosis of Subdural Hemorrhage in Infants and Children**

- Accidental or abuse trauma
- Birth trauma
- Congenital malformations (eg, arteriovenous malformation, aneurysm, arachnoid cysts)
- Disseminated intravascular coagulation
- Hemophilia or other inherited bleeding disorder
- Infection (eg, meningitis, herpes simplex virus)
- Metabolic disorders (eg, glutaric aciduria type 1, hemophagocytic lymphohistiocytosis, Menke disease, osteogenesis imperfecta)
- Radiation or chemotherapy effect
- Tumor
- Vasculitis (eg, Kawasaki disease, lead toxicity, moyamoya disease, systemic lupus erythematosus)
- Vitamin K deficiency in newborn

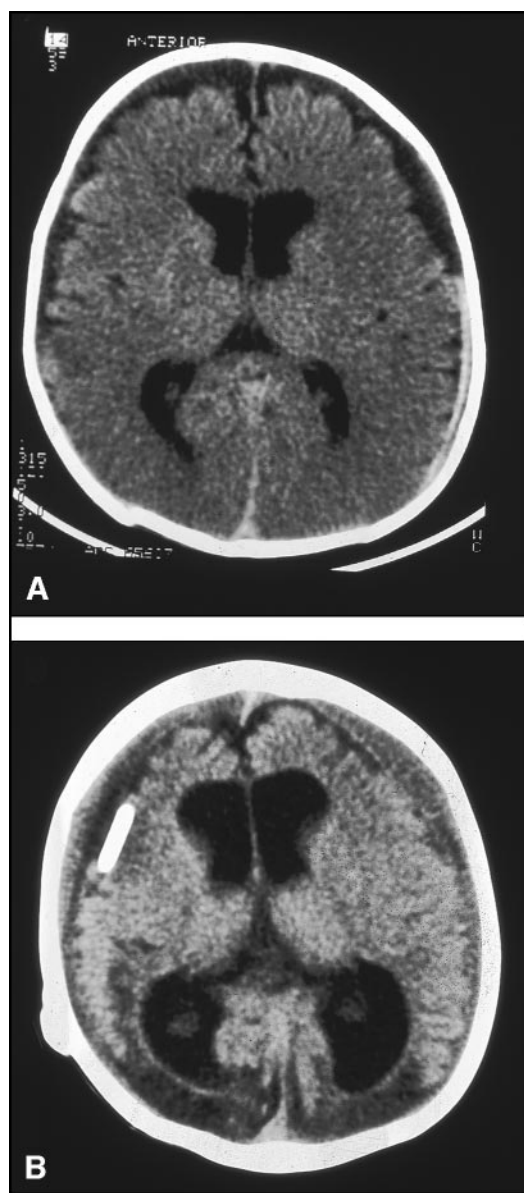
The diagnosis of “benign extracerebral collections of infancy” or “benign subdural effusions of infancy” remains a poorly studied entity, and previous case descriptions lacked detailed evaluations to exclude inflicted head trauma. The hypothesis that an enlarged subarachnoid space predisposes to subdural hemorrhage has not been studied prospectively. Thus, this concept should be viewed cautiously.

### Signs, Symptoms, Examination

Signs and symptoms of SBS can vary from mild and nonspecific to severe and life-threatening. A history of poor feeding, emesis, lethargy, other changes in neurologic status (including coma and seizures, irritability), limpness, and changes in respiration pattern (including apnea) have been reported. Delay in care and false or evolving histories can complicate the presentation and lead to increased morbidity and mortality. Minor or moderate trauma may result in nonspecific symptoms that often are minimized or attributed to viral illness, colic, or feeding problems. The more severe presentation might be misinterpreted as meningitis. Bloody or xanthochromic spinal fluid should raise the suspicion of cerebral trauma. Other abnormal laboratory values, such as anemia and coagulation abnormalities, also may be a result of brain injury.

Bruises, rib or long bone fractures, or other systemic trauma may be present. External signs of head trauma, such as swelling, bruises, and skull fractures, may be





**Figure 4.** Shaken baby syndrome. A. Acute left parietal subdural and interhemispheric hemorrhage and chronic frontal subdural hematomas in a 5-month-old who presented with a history of apnea, recurrent emesis, acute seizure, and healing rib fractures. The unemployed father, who was stressed by care, admitted to shaking the infant on three occasions. B. Computed tomography of the head 2 years after injury demonstrates encephalomalacia, volume loss, ventriculomegaly, and catheter placement. The child had spastic diplegia, seizures, and blindness in one eye from retinal detachment.

absent, but their presence indicates blunt impact as part of the mechanism of injury.

Infants who present with head injury should undergo

neurologic assessment for associated spinal cord and cervical spine injury. Further imaging of the craniocervical junction should be pursued in patients if the history is of concern and examination results are persistently normal. Although postmortem findings of cervical cord hemorrhage have been demonstrated, the absence of any external neck bruises or cervical spinal cord or spine fractures does not exclude SBS as a mechanism for injury.

### Radiology

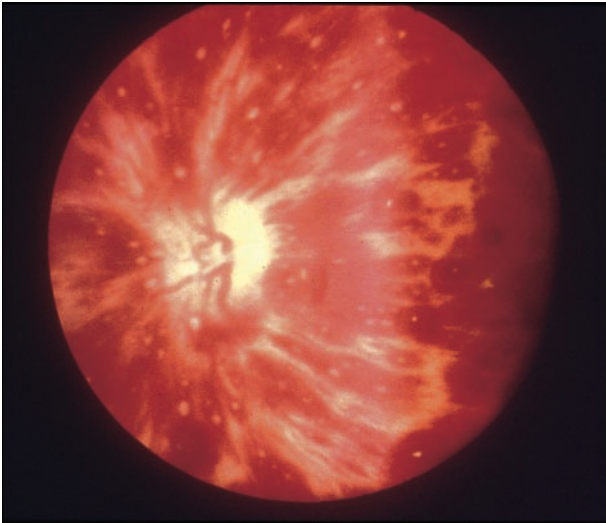
Computed tomography (CT) remains the initial imaging modality for the brain-injured infant and child and is best for showing acute subdural, subarachnoid, and interhemispheric hemorrhage routinely seen in SBS. CT also can be helpful in excluding conditions that might present with intracranial hemorrhage. CT can fail to reveal some aspects of injury, particularly in the evolution of cerebral edema. It can differentiate between epidural hematomas (more often an accidental injury) and subdural hematomas. Chronic subdural hematomas suggest the possibility of recurrent or prior trauma, and it is noteworthy that minor acute hemorrhage into chronic subdural hematomas can occur with both nonintentional and intentional trauma. Repeat CT as the infant stabilizes is useful to demonstrate resolution of edema, mass effect, and possible subsequent infarctions. Sequelae of SBS on CT often include focal or global volume loss, enlarged ventricles, encephalomalacia, and porencephaly (Fig. 4).

Magnetic resonance imaging (MRI) is a useful adjunct to CT in the evaluation of head trauma, but its usefulness is limited by availability, difficult access in the critically ill patient, and relative insensitivity to subarachnoid blood and fractures. MRI can detect intraparenchymal lesions such as shearing injury better than CT and should be considered several days after initial CT scans. Caution should be exercised in “dating” subdural hematomas using either CT or MRI. Clinical history and presentation must guide the initial timing of any traumatic brain injury. MRI can assist only in demonstrating the changes in the chemical states of hemoglobin in the affected areas of the brain, giving an estimate only of when an injury may have occurred.

### Retinal Hemorrhages

Any infant or child who has intracranial hemorrhage suspicious for abuse should be evaluated by a pediatric ophthalmologist to document retinal hemorrhages (RH). RH occur in 50% to 80% of abusive head injuries and can be unilateral or bilateral.

The description of RH should be specific to help determine the cause. The number (few, moderate, too



**Figure 5.** Multiple extensive retinal hemorrhages in a 6-month-old infant who has subdural hematomas are diagnostic for child physical abuse.

numerous to count), type (preretinal, subretinal, intraretinal, vitreous), pattern and location (posterior pole, radiating from optic nerve, extending to the periphery, perivascular, random, focal, diffuse) should be included in reports. Multiple retinal hemorrhages, involving more than one layer of the retina without evidence of papilledema or underlying retinal disease, strongly suggest inflicted head injury (Fig. 5). Nonhemorrhagic changes (retinoschisis and macular folds) have been reported only in SBS. Retinal and optic nerve detachment can occur in the most severe cases. Optic nerve sheath hemorrhage often is identified on autopsy.

RH are identified in fewer than 3% of patients evaluated for nonintentional head injury and are characteristically focal and located in the posterior pole in the superficial layers of the retina. There have been few case reports of RH sustained during motor vehicle accidents involving severe impacts and in witnessed accidental household falls. In one report of household falls involving three patients in which RH were present, they were described as ipsilateral to the intracranial hemorrhage and isolated to the posterior pole. Detailed information in the medical literature differentiates RH from abuse and RH from unintentional injury.

Less common causes of RH include meningitis and other infectious illness, Henoch-Schönlein purpura and other vasculitides, use of extracorporeal membrane oxygenation, arteriovenous malformation, and severe hypertension. RH are *not* caused by cardiopulmonary resuscitation.

### Prognosis and Outcomes

The pathophysiology of RH is not understood completely and may involve several mechanisms. Correlation is good between the severity of the RH and the severity of the intracranial injury. RH can resolve within 10 days to several months. Generally, less severe hemorrhages (those occurring from birth trauma) resolve in fewer than 2 weeks; more traumatic retinal injury resolves slowly and requires close ophthalmologic follow-up. Outcome data have begun to show that some infants who have minor RH may experience good outcomes, but severe RH, especially in conjunction with presentation of coma, cerebral edema, or occipital lobe damage, may have very poor outcomes, including permanent blindness. Overall, two thirds of those who survive inflicted head injury have some form of visual impairment, and of those, one fourth to one third will be blind.

Outcome studies of inflicted head injury indicate that one third of victims die, one third of infants have severe disability (eg, seizures, neurologic deficits, cerebral palsy, spasticplegias or severe motor dysfunction, blindness, deafness), and one third appear “normal” in the short term. Studies also have demonstrated that this latter symptom-free population may manifest severe developmental consequences (eg, language and visual impairment, behavior and education difficulty, psychological disorders) over an extended time. Deceleration of brain growth (microcephaly) was the most constant predictor of poor long-term neurologic sequelae in one study. Feeding tubes, tracheotomy dependency, ventriculoperitoneal shunts, and the need for chronic seizure medications may become necessary. Primary care may require augmentation by a vast array of developmental disability and rehabilitation services. Death can occur from long-term complications of head injuries.

As part of anticipatory guidance and routine care, pediatricians should include in their discussions information about caretaker stress, family support structure, and response to the crying infant that can highlight the dangers of SBS. Identification of risk factors in the home is vital. Education about choosing safe child care is valuable but may not prevent the unexpected event of physical abuse in an extrafamilial care setting. Home visitation programs are an important resource to disseminate information on prevention of SBS.

### Reporting and Management

When child physical abuse is suspected, based on the presentation, history, and physical examination, the clinician is responsible for reporting abuse to the appropriate agency for investigation. Physicians may hesitate to

report suspicions because the doctor/family relationship may be compromised; office time and revenue may be lost; or involvement with human services, police, or the court system causes anxiety. A physician also may feel inadequately trained or uncomfortable when evaluating suspected child abuse.

Physicians, however, have a legal and ethical responsibility to report any suspected child physical abuse to the appropriate agencies. In most cases, the agency receiving the report will be the county child protective service agency. Law enforcement also receives such reports. The purpose of reporting is to permit the professionals to gather the information needed to determine whether the child's environment (home, foster home, school, child care) is safe, to ascertain whether abuse has occurred, and to develop an immediate safety plan for the child to ensure that he or she remains safe and to prevent reinjury.

The physician should view his or her role as a medical professional as part of the interdisciplinary approach to

appear to complicate the role of the pediatrician in discussing child abuse with governmental agencies. It should be noted, however, that the mandated reporting laws in every state supercede the restrictions of HIPAA relating to confidential medical records. The minimum health care information necessary to report child abuse and neglect, domestic violence, assaults, or injuries can be released, as mandated by law, without authorization by the family. In most cases, disclosure of information beyond what is needed to report abuse or assault requires authorization from the family or, according to HIPAA, a warrant, subpoena, or court order. For example, the medical record of a parent or sibling of an abused child and other information in the record not related to the acute injury reported as physical abuse requires the necessary authorizations. The pediatrician should review office procedures regarding medical records to assure HIPAA compliance as well as review hospital policies relating to the release of records in child abuse and neglect cases.

Preparation for court begins with the careful and legible documentation of the medical record. The physician may be asked to review social services records or investigative reports relating to the abuse injury. A general pediatrician can testify as either the treating physician of record or as a court-qualified expert in the area of pediatrics or the evaluation of child abuse. The court process is

another potential area of stress for the practitioner, and although most reported child abuse cases do not require a physician in the court process, the pediatrician's participation should be considered an important advocacy role in the protection of children from abuse and neglect.

Families, as possible perpetrators, have the right to be represented in court. An advocate for the child, a *guardian ad litem*, can be appointed by the court to represent the child's legal best interests. The standard of proof in a civil court, where most child abuse and neglect cases are heard, is the preponderance of evidence. This means that the court must have more than 50% proof that abuse or neglect has occurred. The purpose of the court is not accusatory but rather to assure the safety of the child, to outline and mandate a treatment for the family to address the circumstances that led to the abuse or neglect of the child, and to have the court order monitoring of the treatment plan through the department of child protective services.

**The mandated reporting laws in every state (the required reporting of all suspected abuse cases) supercede the restrictions of HIPAA relating to confidential medical records.**

the intervention, assessment, and subsequent case management of the child abuse report. Follow-up conversations with child protective services or law enforcement regarding the physician report may be needed, for example, to explain the reported physical abuse injury, the required treatment, and the possible prognosis for the child. If it is believed that the child is not safe or there is difficulty in finding a safe placement through a child protective services agency, the child should be hospitalized pending further evaluation.

The physician should discuss the reporting process with the family and inform them of what to expect after the report is made. One should anticipate a family's difficult questions, which may not have immediate answers (eg, Will my child be taken away? Will we still see our child? Will social services place my child in foster care? Does our family need a lawyer?).

Recent federal HIPAA regulations regarding the protection and disclosure of private health information may

Criminal court proceedings are held to punish and deter behavior. The state attempts to prosecute a perpetrator in a child abuse case in which there has been serious bodily harm or death. The definition of serious bodily harm may vary from state to state, but generally implies a severe injury that is either life-threatening, disfiguring, or has the potential for loss of function of a body part or organ system. For example, a shaken baby who has subdural hemorrhage and retinal hemorrhage meets the definition of serious bodily harm because the injury could be life-threatening, with the potential for significant morbidity and loss of function in terms of overall child development. This standard of proof in criminal court is “beyond a reasonable doubt” or greater than 99% that an abusive event has occurred. Physicians who are subpoenaed to testify in child abuse cases should access the local District Attorney for criminal cases and the County Attorney for civil cases in juvenile court to discuss preparation for testifying in the case. Consultative support from a pediatrician who is a regional consultant and expert in the field of child abuse can be accessed through the American Academy of Pediatrics, Section on Child Abuse and Neglect.

## Treatment

The treatment of physically abused children beyond the injuries themselves and the treatment of the abusive family generally is outside the scope of the general pediatric practice. After a mandated report is made and if the case is substantiated as physical abuse or neglect, the county or state department of social services is responsible for developing, implementing, and monitoring family treatment. Budget crises in many states have negatively affected the ability of departments to offer the comprehensive and focused treatment that families may require.

Multiple programs over the past 3 decades have attempted to deliver such services to both children and families. Respite care or “crisis nurseries,” therapeutic preschools, temporary receiving or foster homes, and “parenting classes” are examples. The demand far exceeds the availability of many such programs, and there are few data to support the efficacy of many of these interventions. Research has begun to address the effects of foster and kinship care placements on behavioral health outcomes and risk-taking behaviors in later adolescence. Further research on foster care populations likely will address medical care needs, mental health treatment, service delivery, and child welfare policy that affects this vulnerable population.

A recent study (7) described neurobiologic experi-

ments and brain imaging studies undertaken in victims of childhood abuse. The research suggests that dysfunction of the limbic system, caused by overexcitation during the developmental process, is the cause of antisocial behavior observed in adults abused as children. The author suggests that these neurobiologic and molecular effects induced by stress and resulting in modifications of brain development serve as adaptations to an adverse environment.

## Prevention

Physical abuse can be prevented in many cases. The subset of cases in which an unexpected and violent assault by an adult, often under the influence of drugs or alcohol and often unrelated to the child (mother’s boyfriend or the babysitter), however, may not be completely preventable. Extensive experience and evaluation of high-risk families has shown that home visitation services can prevent physical abuse of children. Nurses or paraprofessionals can provide services, but more data are available on the efficacy of the nurse model.

Parent education and anticipatory guidance also are important, especially with respect to handling situations that stress parents (eg, colic, crying, toilet training, temperament), age-appropriate discipline, general developmental issues, home safety, and violence screening. These efforts can be directed at each stage of child development and family-physician interaction. During prenatal and perinatal health supervision visits, for example, the physician can identify families at risk, recognize early bonding and attachment problems, and ask questions about postpartum adjustment.

Frequently, the pediatrician is confronted with the child who has “behavior problems” in school or at home. Behaviors such as enuresis, sexually acting out, aggression, or withdrawal may be behavioral sequelae of abuse or violence at home. Similarly, long-term sequelae of abuse must be anticipated and recognized in the older child and adolescent. School failure, truancy, running away, substance abuse, suicide attempts, and early pregnancy are problems not always related to abuse, but the physician should consider this possibility, discuss it with the family, and advocate for mental health support for the child and family. A lifelong, primary care-based approach to screening for risk factors combined with anticipatory guidance-based education prevention of child abuse can help break the intergenerational cycle of abuse and neglect.



## Summary

Information that can help in identifying, reporting, and treating child abuse and neglect is more readily available to the pediatrician than ever before. Family and community violence remain national public health concerns. The medical literature on the epidemiology of child abuse and violent behavior continues to expand, as does the body of knowledge on the developmental and behavioral outcomes of abuse, current treatments, and prevention of child abuse via home visitation. The lack of funding for both medical and mental health-based child abuse research and the continual need for trained researchers and clinicians in the field remain challenges. With the current economic downturn and budget crises, the community response to reports of abuse and neglect and to requests for services for families at risk might suffer. Now, more than ever, the pediatrician must advocate at the local community and national governmental levels for prevention, intervention, treatment, and support services for child abuse victims and their families.

The pediatrician should not be deterred from reporting child abuse concerns because “nothing will happen” or “services cannot be provided” to a family or child. Pediatricians play a vital role in educating social service agencies about treatments needed for the abused child, in supporting parents by helping them acknowledge the problems that led to the abuse, and in enabling them to ask for help before abuse occurs. As C. Henry Kempe said, the parents who “love their children very much, but not very well” need our help so they might learn to love and raise their children nonviolently.

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## PIR Quiz

Quiz also available online at [www.pedsinreview.org](http://www.pedsinreview.org).

1. Certain mechanisms of injury may result in specific fractures, and certain fractures in a child carry a higher specificity for abuse than others. Of the following, the clinical presentation that is *most* specific for abuse is:
  - A. Digital fractures.
  - B. Long bone shaft fractures.
  - C. Rib fractures, especially posterior location.
  - D. Simple linear skull fractures.
  - E. Subperiosteal new bone formation.
2. External signs of physical abuse, such as bruises, are identified in many children in whom abuse or neglect is suspected. Documenting their number, size, color, pattern, and location is critical. Pediatricians should be cautious when asked the exact age of bruises because:
  - A. Bruise color depends on injury depth and skin color.
  - B. Bruise color depends on the child's age.
  - C. Bruises cannot be distinguished from "coining."
  - D. Bruises rarely are noted in abuse cases.
  - E. "New" bruises are yellow or brown.
3. Statistics from 2002 report that the *most* common form of child abuse suffered by victims is:
  - A. Emotional abuse.
  - B. Multiple forms of abuse.
  - C. Neglect.
  - D. Physical abuse.
  - E. Sexual abuse.
4. Accidental (nonintentional) impacts rarely cause severe or fatal intracranial injury in infants. For infants younger than 1 year of age, the percent of serious intracranial injuries that are the result of physical abuse is *closest* to:
  - A. 25%.
  - B. 40%.
  - C. 60%.
  - D. 80%.
  - E. 95%.
5. Retinal hemorrhages occur in 50% to 80% of abusive head injuries. Physical findings associated with these hemorrhages that strongly suggest an inflicted injury include the presence of:
  - A. Focal location.
  - B. Macular folds.
  - C. Papilledema.
  - D. Single hemorrhage.
  - E. Superficial retinal layer involvement.