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Child abuse and neglect are common occurrences and result in significant morbidity and mortality. In the United States during 2001, an estimated 903,000 children were victims of child maltreatment, resulting in 1300 deaths. The most common risk factors for child abuse and neglect are poverty, substance abuse, and domestic violence.

Children who have been physically abused often present with an unexplained or unwitnessed injury, a delay in seeking care, a serious injury alleged to be self-inflicted or caused by a young sibling, or multiple injuries in various stages of healing. Abusive head trauma may be difficult to diagnose because many of the symptoms are non-specific, so the physician must have a high index of suspicion to avoid missing this diagnosis.

A normal physical examination is common among victims of child sexual abuse, and diagnostic physical findings are observed in fewer than 10% of victims. Therefore, the most important information in making the diagnosis of child sexual abuse is the history.

Child maltreatment is a major public health problem. Children who experience abuse or neglect are at risk for behavioral, learning, physical, and mental health problems. The morbidity and mortality for patients with abusive head trauma is especially

high. There now is established a clear connection between child maltreatment and many of today's most important societal and public health problems, including alcoholism, drug abuse, depression, suicide attempts, smoking, severe obesity, ischemic heart disease, and cancer.¹ The total costs, both direct and indirect, of child abuse and neglect in the United States have been estimated to exceed a staggering \$94 billion per year.²

All 50 states have a statute providing state child protective service (CPS) agencies the authority and mandate to accept and investigate reports of suspected child abuse or neglect. The primary responsibility of the physician is suspecting the diagnosis of child abuse or neglect, then reporting it to the appropriate authorities. A report of suspected child maltreatment is not a diagnosis or accusation. It is a call for additional investigation to help determine whether child abuse or neglect actually has occurred.

Physicians never should underestimate their importance when acting as advocates for children. This may be done by helping to assure that a child suspected of being abused or neglected is returned to a safe home environment, or by being willing to document and explain their assessment and concerns for investigators. The physician who is willing to act on behalf of a child sus-

Child Abuse: An Overview for the Primary Care Physician

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pected of being abused or neglected is one of the most important advocates a child can have.

—The Editor

History of Child Abuse

Child abuse has occurred since ancient times, though its recognition and intervention on behalf of child victims has been a relatively recent phenomenon in the United States.³ The first child in this country to be removed from her home because of child maltreatment was named Mary Ellen, who lived in New York City. Her stepmother chronically and severely physically abused Mary Ellen. All her injuries ceased in 1874 after a court placed her in the custody of a woman who eventually adopted her. The organization most instrumental in advocating to the courts on Mary Ellen's behalf was the New York Society for the Prevention of Cruelty to Animals. It wasn't until the following year that the New York Society for the Prevention of Cruelty to Children was formed.³ The United States, therefore, has a longer legacy of intervening on behalf of endangered animals than children.

Radiologist John Caffey in 1946 was the first United States physician to describe children with unexplained injuries and actually question whether they were inflicted.⁴ Kempe and colleagues' landmark article, "The Battered Child," was published in 1962, and first described in detail the problem of physical abuse to children.⁵ In large part due to Dr. Kempe's efforts, by 1968 all states had passed legislation creating CPS agencies.³ The mandate for these agencies is to investigate reports alleging

child abuse or neglect, and provide intervention or services on behalf of children who are deemed at risk.

The medical literature related to child abuse and neglect reflects increasing research and expertise over the years. In 1965, the subject heading of child abuse was introduced in the National Library of Medicine's MEDLINE database, and 30 articles concerned this topic. A current search of MEDLINE yielded 15,830 articles concerning child abuse. This subject area includes child physical abuse, sexual abuse, neglect, and Munchausen syndrome by proxy. For 1990 through late February 2004, MEDLINE has 10,074 articles on child abuse. Thus, 64% of all publications concerning child abuse cited in MEDLINE have been published since 1990.

There are several reasons why all physicians should be aware of child abuse and neglect. First, as the following epidemiologic data shows, it happens. Second, the morbidity (which extends into adulthood) and mortality resulting from this problem are significant. Third, child maltreatment differs from most other medical situations in that the history offered not always is accurate or true. Physicians-in-training are taught the importance of the history in making an accurate diagnosis.^{6,7} When the history is not available, complete, or truthful, a physician's ability to make a correct diagnosis is seriously compromised. Fourth, it differs from other medical problems in that civil and/or criminal investigations and legal proceedings may result from or occur in association with the physician's involvement. Parents actually may lose custody of their children, and they or caretakers of their children may be criminally prosecuted based on the results of these investigations.

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Epidemiology of Child Maltreatment

Data from CPS agencies demonstrate that in 2001, an estimated 903,000 children were victims of child maltreatment in the United States. This translates to an incidence of 12.4 per 1000 children. There were an estimated 1300 deaths due to abuse or neglect in 2001.⁸ This figure, however, is likely an underestimate, based on what is known about the inaccuracies of death certificates and vital statistics data.^{9,10}

Neglect allegations accounted for 57% of CPS referrals, physical abuse 19%, and sexual abuse 10%.⁶ Data from anonymous adult telephone surveys suggest that approximately one-fourth of women and one-sixth of men were sexually abused as children.¹¹ Thus, sexual abuse may be the most underreported type of child maltreatment.

The literature demonstrates the prevalence of child maltreatment in various medical settings. For example, among patients seen in a pediatric emergency department with trauma, child abuse was suspected in 4%.¹² Substantiated abuse was documented in 3.3% of patients with burns seen at one pediatric emergency department.¹³ Approximately 24% of children younger than 3 years of age with fractures are found to be abused.¹⁴ Child abuse is the most common cause of serious intracranial injury in infants, and head injury is the most common cause of death due to child abuse.^{15,16} Finally, in the 1980s, homicide surpassed motor vehicle accidents as the leading cause of injury-related death among infants.¹⁷

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Table 1. Risk Factors for Child Maltreatment¹⁹**CAREGIVER OR FAMILY CHARACTERISTICS**

- Poverty (especially for serious neglect and physical abuse)
- Substance abuse
- Domestic violence
- Social isolation
- Family history of abuse, neglect, and/or violence
- Unemployment
- Low self-esteem
- Poor impulse control
- Mental health problems (e.g. anxiety, depression)
- Inappropriate expectations of the child/development
- Negative attitudes toward parenting

CHILD CHARACTERISTICS

- Age younger than 4-5 years (especially for fatalities)
- Prematurity
- Handicaps
- Irritable temperament, colicky infant
- Female gender (sexual abuse)

Child abuse is a major contributor to morbidity and mortality in the pediatric intensive care unit.¹⁸ Although accounting for only 1% of admissions, physical abuse accounted for 16% of deaths. The case fatality rate for patients admitted to the intensive care unit for abuse-related injuries was 53%, and of those who survived 50% were permanently disabled. Physical abuse was actually the most expensive diagnosis group.

Risk Factors for Child Maltreatment

Many risk factors have been identified in studies of child abuse and neglect. The most commonly cited are poverty, substance abuse, and domestic violence.¹⁹ Table 1 includes these and other risk factors. Physicians of all specialties should be aware of the relationship between domestic violence and child abuse. Studies have consistently shown that in homes where there is domestic violence, and in which there are children present, there is an approximately 50% incidence of child maltreatment.²⁰

The highest-risk children tend to be the youngest, especially younger than 4 years of age. These children are the least able to defend themselves, are relatively socially isolated (not attending school), and are unable to obtain food and other necessities for themselves. Two common precipitating events in serious or fatal physical abuse cases are either a young infant who will not stop crying, or an older infant or younger toddler who has a “potty training” accident.

Most often, the perpetrator is someone close to and well-known to the child. A parent (including biological parent, adoptive parent, or step-parent) is responsible for 86% of instances of neglect, 78% of physical abuse, and 40% of sexual abuse.⁸ The most common perpetrators of abusive head trauma, in order of frequency, are the father (37%), boyfriend of mother (20%), female babysitter (17%), and mother (13%).²¹

Table 2. Child Abuse Reporting Laws—General Provisions

- | | |
|----------------------|-------------------------------|
| • Mandated reporters | • Confidentiality |
| • What to report | • Photographs and radiographs |
| • Where to report | • Protection for reporters |
| • How to report | • Failure to report |

Child Abuse Reporting Laws

All 50 states have statutes providing state CPS agencies the authority and mandate to accept and investigate reports of suspected child abuse or neglect. The general areas that these reporting statutes cover are similar and listed in Table 2. The list of mandated reporters is lengthy and generally includes any professional who may be expected to come into contact with children during their daily work. The current list of mandated reporters in the Ohio statute, as an example, is in Table 3. Reports to CPS usually can be made by telephone, though some agencies may require a written report. Physicians should be familiar with the basic tenets of their state’s child abuse reporting laws.²²

Whether law enforcement investigates alleged child maltreatment depends upon several factors, including the type of allegation (e.g., all sexual abuse of children is a crime), severity of abuse or neglect, and whether a suspect is identified. In any case, the questions that CPS and/or law enforcement must address in their investigations include: Was the child abused or neglected? If so, who did it? Is there risk for future abuse and/or neglect? And finally, should steps be taken to protect the child?

Professionals encountering suspected child abuse or neglect during their daily work account for 56% of reports to CPS agencies.⁸ Educators, legal or law enforcement professionals, and social service professionals each accounted for 15-16% of reports. Medical professionals made 8% of reports.

Multidisciplinary team assessment is the standard of care for child maltreatment. While a team’s composition and process may vary depending on local factors, it will typically include representatives from health care, mental health, child protection, law enforcement, and prosecution, to name the most common. Multidisciplinary teams have been shown to increase the accuracy of assessment and the likelihood that a child and family receive needed services.²³⁻²⁵ The most recent advancement in the multidisciplinary approach is the children’s advocacy center (CAC). A CAC is a centralized, child-oriented facility for child interviews, multidisciplinary investigation and consultation, and treatment services for victims and families. The first CAC was started in Huntsville, AL in 1987. In the United States, there are approximately 500 full and associate member centers accredited by the National Children’s Alliance.²⁶

Child Physical Abuse

Just as in any other area of medicine, the history is the most important information for the physician in determining whether to consider an injury suspicious for being inflicted. It is helpful to consider what is known about well-documented unintentional

Table 3. Mandated Child Abuse Reporters in Ohio*

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Attorney • Speech pathologist or audiologist • Physician, including a hospital intern or resident • Coroner • Dentist • Administrator or employee of a child day-care center • Podiatrist • Administrator or employee of a residential camp or child day camp • Practitioner of a limited branch of medicine (e.g., massage therapy) • Administrator or employee of a certified child care agency or other public or private children services agency • Registered nurse • School teacher • Licensed practical nurse | <ul style="list-style-type: none"> • School employee • Visiting nurse • School authority • Other health care professional • Person engaged in social work or the practice of professional counseling • Licensed psychologist • Agent of a county humane society • Licensed school psychologist • A person rendering spiritual treatment through prayer in accordance with the tenets of a well-recognized religion • Independent marriage and family therapist or marriage and family therapist |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
- * Adapted from Ohio Revised Code 2151.42.1.

childhood injuries. Children who sustain significant unintentional injuries typically are brought to medical attention promptly or in a way that easily can be corroborated, the incident either is witnessed or easily verified, the history remains consistent, and the injury or injuries make sense given the history. Examples include motor vehicle crashes and playground injuries.

In contrast, children who have been physically abused often present with an unexplained injury or injuries. Alternatively, the history will be implausible and not adequately explain the injury. Often, there is no eyewitness to corroborate the incident. Another common feature is a delay in seeking care. Especially in young children and infants, an abusive injury may be explained as self-inflicted, or caused by a young sibling. A changing history may be observed, especially after an initial history is questioned. Whenever one or more of these features are encountered, the physician needs to consider the possibility of physical abuse and pursue this possibility by obtaining more information. It is good practice whenever a child is found to have injuries to ask the parent and/or child how each one occurred. Then the physician should consider whether the explanation offered could account for the injury.

Differential Diagnosis of Physical Abuse. The differential diagnosis of physical abuse is extensive. A large number of medical conditions have been described that may present with unexplained findings which mimic injury and therefore abuse.^{27,28} These conditions are outlined in Table 4. Considering the number and type of conditions that may be mistaken for abuse, the importance of other aspects of the history and physical examina-

Table 4. Differential Diagnosis of Child Physical Abuse^{27,28}

General	Unintentional injury, lack of supervision, neglect
Cutaneous	<p><i>Mistaken for bruises:</i> Normal bruises, Mongolian pigmentation</p> <p><i>Dermatologic:</i> Hemangiomas, erythema mutiforme, Henoch-Schönlein purpura, hypersensitivity vasculitis, Ehlers-Danlos syndrome, phyto-dermatitis, contact dermatitis, head lice with maculae ceruleae, dye staining of skin, striae</p> <p><i>Hematologic:</i> Hemophilia, von Willebrand's disease, idiopathic thrombocytopenic purpura, leukemia, vitamin K deficiency, purpura fulminans, disseminated intravascular coagulation, other factor deficiencies</p> <p><i>Folk medicine practices:</i> Coining, cupping</p> <p><i>Mistaken for burns:</i> Phytodermatitis, impetigo, dermatitis herpetiformis, diaper dermatitis, chilblain, drug eruption, mechanical abrasion, toxic shock syndrome, chemical burns, epidermolysis bullosa, folk treatments (e.g., moxibustion), accidental (contact) burns, chemical burns</p>
Skeletal	Birth injury; forceful manipulation (e.g., passive exercise, chiropractic manipulation, postural drainage); rickets of prematurity; osteogenesis imperfecta; osteopenia due to immobilization, nutritional problems, Down syndrome, chronic pulmonary disease, drugs (prostaglandin, methotrexate, hypervitaminosis A, anticonvulsants); Menkes' syndrome; rickets; scurvy; congenital syphilis; congenital indifference to pain; osteomyelitis; Caffey's disease; hypophosphatasia
Head Injury	Accidental injuries and falls, intracranial vascular anomaly (aneurysm, arteriovenous malformation), benign enlargement of the subarachnoid spaces, metabolic disorders (e.g., glutaric aciduria type 1, Ehlers-Danlos syndrome, Menke's syndrome), bleeding disorders (e.g., vitamin K deficiency, hemophilia, von Willebrand's disease, thrombocytopenia), prenatal and perinatal trauma, dural and cortical venous thrombosis, sudden infant death syndrome, hypernatremic dehydration, vitamin A intoxication, infection (e.g., bacterial meningitis, congenital syphilis, herpes encephalitis, osteomyelitis, tuberculosis), vitamin deficiency (rickets, scurvy), brain tumor, folk treatments (e.g., caida de mollera or sunken fontanelle). (For further details and a more extensive differential diagnosis, see references 1, 29, and 36.)
Other	Alopecia areata, tricotillomania, tinea capitis, loose anagen hair syndrome, hair tourniquet, immune deficiency

Figures 1a-b. Pattern Injuries to Skin Due to Abuse



1a. Coat hanger marks on lower back

1b. Burns to feet due to stove burner

tion become obvious. For example, family history may be critical in deciding whether to pursue evaluation for conditions such as osteogenesis imperfecta or von Willebrand's disease. Laboratory tests, x-ray evaluation, or subspecialty consultation for conditions such as bleeding or bone disorders should be directed by the patient's findings and the medical and family history.

The most common consideration in a child with an unexplained injury is whether it could be unintentional. The physician, therefore, needs to be familiar with common patterns of unintentional as well as inflicted injury.^{28,29}

Finally, unexplained injuries may result from parental unawareness of danger, lack of supervision, or neglect. These issues sometimes best are clarified by thorough CPS and/or law enforcement investigations.

Cutaneous Manifestations of Child Abuse. Cutaneous injury is the most common manifestation of physical abuse. Determining if an injury is due to abuse can be difficult. Child abuse should be suspected if an inflicted and nonaccidental skin injury involves more than temporary reddening of the skin.³⁰ Pattern injuries (e.g., a contusion, abrasion, or burn in the pattern of an object) should always raise concern for abusive injury. Other cardinal signs of abuse include multiple injuries of different ages. Recent research, however, suggests that dating of bruises by their color is not very reliable.²⁹⁻³² Physicians also should be aware of published data showing characteristics of bruises by age and location in non-abused young children and infants. For example, bruising is rare in infants younger than 6-9 months, increases with increasing mobility of the infant, and when seen usually is on the front of the body and over bony prominences, and not on the hands and buttocks.³³⁻³⁵ Figures 1a-b illustrates some examples of pattern injuries to the skin.

Careful and complete documentation of the history, findings, assessment, and management plan is important. Investigators will compare statements given by caretakers and witnesses with the medical history. Findings should be described carefully and measured, even if photographs are taken. Photographs may become lost or their quality may be inadequate. Records are critical for the physician and others in the event of legal proceedings

that may occur weeks, months, or even years later. The physician should document any suspicion of abuse or neglect. Without documentation of the concern, caseworkers and detectives are unable to pursue an investigation or any legal action on behalf of the child. In fact, the more clearly the physician documents the history, findings, and assessment, the more likely those records are to be substituted for actual testimony in certain settings.

The most common burn injuries in children, whether unintentional or abusive, are due to scalds. The most common culprit is hot water, and a classic pattern in abusive scald burns is the immersion burn. In such cases, the extremities often have a "glove" or "stocking" distribution. Areas of the body that are juxtaposed or in contact with a relatively cooler surface, such as a bathtub, will have more superficial involvement or be spared. Full-thickness burns can occur rapidly in hot water. For example, a water temperature of 140° F (60° C) is estimated to take only one second to cause a full-thickness burn in a child.³⁸

Skeletal Manifestations of Child Abuse. Skeletal injury is a common manifestation of abusive injury. The history (or lack thereof), setting, and associated injuries are important in determining whether a fracture should be considered suspicious for abuse. While any bone may be involved, the type of fracture and pattern can be helpful in differentiating unintentional from abusive injury.

Examples of fractures commonly due to abuse are shown in Figures 2a-c. The physician carefully must consider each fracture in the context of the history. While spiral fractures of the long bones are very unusual and often due to abuse in young infants who are not ambulatory, there have been well-documented unintentional spiral fractures in infants.³⁹ Once infants and toddlers become ambulatory, they may generate sufficient force to sustain a spiral fracture of the lower extremity (usually tibia) as a result of a fall associated with twisting of the leg.⁴⁰ These are known as toddler's fractures. Classic metaphyseal lesions are shear injuries due to indirect forces associated with twisting, pulling, or flailing of the extremities (the latter during shaking or throwing of the infant).⁴¹ Posterior rib fractures result from severe chest compression with an unsupported back, and have not been described fol-

Figures 2a-c. Examples of Abusive Fractures



a. Spiral fracture of the femur, caused by torsional or rotational force applied to the bone; **b.** Metaphyseal fractures of the proximal tibia and fibula, which result from shearing forces across the metaphysis; **c.** Multiple healing rib fractures (left 3rd through 7th, left 9th posteromedial, and right 2nd through 5th posterior ribs).

lowing chest compressions with basic life support.⁴²

In children younger than 2 years of age with suspected physical abuse, fractures may be identified that are not apparent from the history or physical examination. Diagnostic imaging to evaluate for these so-called occult fractures includes the skeletal survey and bone scan. A skeletal survey is indicated in all such patients, and should be considered individually in patients 2-5 years of age.⁴³ One study showed that a follow-up skeletal survey in infants and toddlers with suspicious injuries yielded additional diagnostic information in 27%.⁴⁴ Bone scans may be useful for detection of occult fractures in certain situations; consultation with a radiologist will assist the physician in obtaining appropriate studies.

Plain x-rays show predictable changes as long bone fractures heal, allowing one to estimate the age of fractures in some cases. Just as with other injuries, fractures of different ages without adequate explanation should cause one to suspect inflicted injuries.

Abusive Head Trauma, Including Shaken Baby Syndrome (SBS)

Pathophysiology. Guthkelch first described subdural hematoma related to whiplash injury in infants, followed by Caffey one year later who expounded on the effects of shaking infants.^{45,46} As originally described, SBS referred to infants with subdural hematomas, retinal hemorrhages, and characteristic bone lesions (especially metaphyseal avulsions). The relationship of brain injury to shaking was based on case reports with caretaker confessions, experiments involving acceleration/deceleration injury in primates, and a case report involving an adult with whiplash injury.⁴⁷⁻⁴⁹

Intracranial injuries in SBS result from forces associated with severe acceleration/deceleration with rotation of the head during violent shaking, often with associated impact.^{16,29,50-52} (See Figure 3.) There are anatomical differences between infants and older

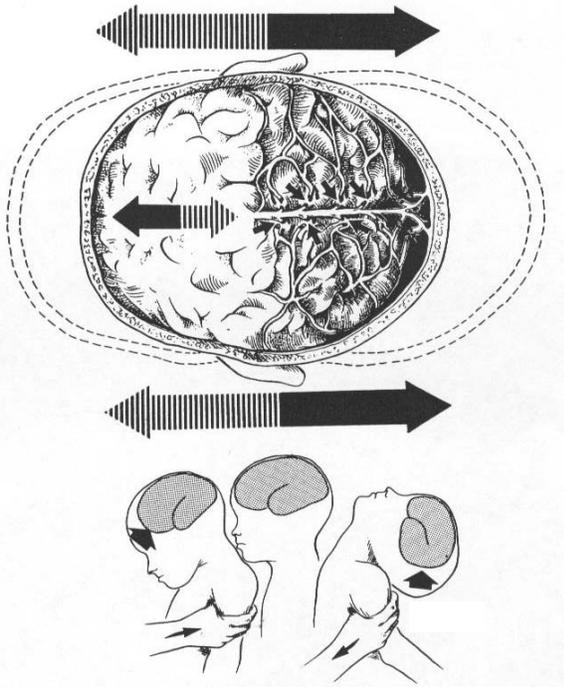
individuals with respect to head size, neck stability, and brain composition that may predispose infants to the injuries seen in SBS. However, the main contributor to injury may simply be the difference in size between victim and perpetrator.¹⁶ Consider that the median age of SBS victims is about 4 months (weight 6-6.5 kg). The perpetrator, being adult, typically weighs at least 60-70 kg, or at least a 10-fold size differential. This would be analogous to an adult being shaken or beaten by someone or something that weighs at least 600-700 kg (1300-1500 lb.).

Some experts have proposed other names for SBS, since the phrase does not fully describe the spectrum of findings, the frequently associated impact injuries, or the age of victims. Alternative names that have been proposed include shaken impact syndrome, whiplash shaken infant/baby syndrome, and abusive head trauma.^{16,50}

The characteristic central nervous system findings include subdural and sometimes subarachnoid hemorrhages. This extra-axial bleeding results from tears in bridging vessels. Subdural hematomas due to inertial forces are typically bilateral and involve the inter-hemispheric fissure.^{29,53} However, unlike those seen in adults after a fall, subdural hematomas in SBS are not usually space-occupying lesions. Rather they are markers for inertial head injury. Secondary brain injury probably accounts for the most significant and life-threatening complications.^{50,54} This includes hypoxia, an inflammatory response, and cerebral edema. It is likely to be exacerbated by a delay in seeking medical care, which is common in child abuse cases. Diffuse axonal injury and injuries to the upper cervical spinal cord also have been described in SBS.^{55,56}

Intracranial injuries in SBS contrast to those sometimes seen with a focal impact head injury associated with a short fall. A small focal subdural hematoma may occur subjacent to a skull fracture, or where the relatively pliable infant skull was deformed at the point of impact.²⁸ Such injuries are not associated with dif-

Figure 3. Mechanism of Whiplash-induced Intracranial Injury



Used with permission from Steven Ludwig, MD.

fuse brain injury and altered mental status as seen with inertial head injury.

SBS victims may not have external evidence of soft tissue injury, even if impact occurred. This can occur for two reasons. The soft tissues of the scalp may mask underlying bleeding and edema that, in fatal cases, may not be visible until the scalp is reflected at autopsy.⁵⁷ The second reason relates to whether any associated impact is against a hard or soft surface. Duhaime and colleagues showed, using a doll model, that shaking alone did not create forces known to cause traumatic unconsciousness in subhuman primates and extrapolated to humans.⁵⁷ However, impact with shaking caused sudden angular deceleration that was increased exponentially compared with shaking alone, and exceeded the estimated threshold for producing concussion, subdural hematoma, and diffuse axonal injury. Regardless of whether impact is against a hard or a soft surface, the resulting forces of deceleration are similar. The difference is that slamming or throwing a baby against a hard surface results in soft tissue injuries and skull fractures. On the other hand, a baby thrown onto a soft object such as a mattress is unlikely to have externally visible soft-tissue injuries. SBS cases also have been described in which there were no impact injuries.^{58,59}

There often are questions about the timing of head injuries. After a severe diffuse brain injury, one sees immediate or rapid onset of neurological symptoms. There is no evidence that a symptom-free lucid interval occurs in such cases. Therefore, if the clinician can identify a time when the child was symptom-free and acting normally, then he or she has identified a time

Table 5. Symptoms and Signs of Shaken Baby Syndrome

- | | |
|-------------------------|----------------------------|
| • Altered consciousness | • Macrocephaly |
| • Apnea | • Microcephaly |
| • Coma | • Respiratory distress |
| • Developmental delays | • Seizure |
| • Feeding problems | • Shock |
| • Hypothermia | • Sudden, unexpected death |
| • Irritability | • Vomiting |

after which a diffuse brain injury must have occurred.^{28,50} Another sometimes-controversial event is re-bleeding within a subdural hematoma. A discussion of this area is beyond the scope of this article, and the reader is referred to a comprehensive and recent review.²⁸

The mechanism of most retinal hemorrhages in SBS is not fully understood.⁶⁰ However, recent research suggests that forces associated with mechanical shaking are the most likely cause, rather than elevated intracranial or intrathoracic pressure, impact head trauma, or direct tracking of blood along the optic nerve sheath.⁵⁹ Furthermore, while retinal hemorrhage may occur in children with intracranial hemorrhage from non-abuse, it is uncommon and less severe than that seen with violent shaking.⁶²

Clinical Findings. Most victims of SBS are infants, and it is rarely seen after age 3. However, it can occur at any age.⁶³⁻⁶⁵ Twins appear to be at increased risk; even asymptomatic twins of victims have been found to have evidence of prior shaking injury.^{66,67}

SBS can be difficult to diagnose because many of the symptoms are non-specific. The most common symptoms are listed in Table 5. Especially among infants with less severe injuries, the physician must have a high index of suspicion to avoid missing the diagnosis. Jenny et al have documented that SBS is not recognized in 31% of cases when initially seen by a physician.⁶⁸ Unfortunately, of those missed cases, 28% had subsequent injuries.

Jenny et al also showed that misdiagnosis is more common in patients who are white with intact families.⁶⁸ Regrettably, this cultural bias in the diagnosis of child maltreatment is a long-recognized problem among health care professionals.⁶⁹

The most appropriate imaging modality for detecting acute intracranial injury is computed tomography (CT), while magnetic resonance imaging (MRI) is more sensitive for identifying certain findings seen in SBS.^{70,71} Other considerations are that CT is more readily available, and does not always require sedation, even in infants.

Retinal hemorrhages are identified in approximately 80% of cases of SBS.⁶⁰ The only adequate way of evaluating the retinas in young children is by having an ophthalmologist perform dilated indirect ophthalmoscopy.⁷² The most characteristic pattern is diffuse, bilateral, with extension towards the ora serrata, and involving pre-retinal, intra-retinal, and sub-retinal layers. There are a variety of types and patterns of retinal hemorrhages, some more specific than others for certain disorders. The interested

reader is referred to an extensive review by Levin.⁶⁰

There may be bruising, especially pattern bruises involving the arms, shoulders, and chest where the baby was grasped. Scalp and intra-oral injuries sometimes are subtle, so those areas need to be examined carefully. In approximately one-third of patients with SBS, older intracranial injuries will be found, indicating previous episodes of shaking.⁷³ Fractures are seen in up to 50% of SBS cases.¹⁶

Diagnosis of Abusive Head Trauma. Patients may present only with intracranial hemorrhages, or with some or all of the other described findings. A minimum evaluation should include head imaging, ophthalmologic examination, skeletal survey, and coagulation screening.

Studies document an association of intracranial injuries with facial and scalp injuries in infants and toddlers, even with a normal neurological examination.^{68,74-76} Hence, intracranial imaging should be done in any infant with suspicious face or scalp injuries, even when the neurological examination is normal. Although CT and MRI, with the latter being more accurate, can assist in estimating the age of subdural collections, making this estimate can be fraught with difficulty.^{77,78}

The differential diagnosis of SBS can be extensive and depends upon the symptoms or findings at presentation. Most cases can be suspected, and ultimately diagnosed, based upon the complete medical history, physical examination, and laboratory and imaging studies mentioned above. The most commonly cited conditions to consider are listed in Table 4. Other references have extensive discussions of the differential diagnosis.^{27,28,60}

Bleeding disorders may predispose to intracranial or other hemorrhage and be confused with SBS. However, it is also important to be aware of the well-known association of secondary disseminated intravascular coagulation with brain injury, including SBS.⁷⁹

Child Sexual Abuse

General Considerations. It is helpful for the physician to understand the dynamics involved in child sexual abuse. Most children are sexually abused by someone they know who is older, on whom they depend, and who, therefore, is in a position of authority over them. Thus, any revelation will be difficult, from the child's perspective. When a child victim discloses sexual abuse, the reaction of those to whom they disclose may influence what the child does next. For example, the disclosure may be met with disbelief or disgust. A child victim who discloses sexual abuse at school may have to undergo questioning by school officials and family, then taken to an emergency department for more questioning and an examination, and finally more interviewing by investigators from CPS and law enforcement. It is not difficult to see, when viewed from the child's perspective, just how difficult and hurtful disclosure can be.

Because most children who have been sexually abused do not have specific residual findings on their physical examination, the most important information is the history. While hearsay exceptions generally allow for a physician to testify about statements made by a patient, this must be balanced against the dangers of

Table 6. Findings Associated with Child Sexual Abuse^{92,93}

DEFINITE INDICATIONS OF SEXUAL CONTACT

- Pregnancy
- Identification of sperm or semen in or on child's body
- Acute genital injuries with no history of accident (hymen laceration or bruising, perianal laceration extending deep to external anal sphincter, healed hymenal transaction that extends to the base of the hymen, absence of hymenal tissue posteriorly confirmed in knee-chest position)
- Photographs or videotapes showing child being abused

FINDINGS CONCERNING FOR ABUSE OR TRAUMA*

- Marked immediate anal dilatation (without stool in rectal vault, constipation/encopresis/neurological disorder/sedation excluded)
- Hymenal cleft in the posterior rim extending more than half the width of the hymenal rim and confirmed in knee-chest position
- Scar or acute laceration of the posterior fourchette
- Perianal scar without other medical (e.g., Crohn's disease) or surgical explanation
- Acute anogenital abrasions/lacerations/contusions
- Bite marks or suction marks on genitalia/inner thighs

* Note: History must be considered for proper interpretation. (See Table 8 for a listing of sexually transmitted diseases.)

inappropriate interview techniques. If the physician does elect to interview the child, he or she must take care to avoid leading questions and situations; should document questions and responses; and should use drawings, dolls, and videotaping only if specifically trained in the use of these techniques. The physician should realize that it is acceptable to take a second-hand history, especially if he or she is not comfortable or specially trained. After suspected sexual abuse is reported to the authorities, the alleged child victim will be interviewed. Increasingly, CPS and law enforcement investigators have received specialized training in interviewing of children. Regardless of the approach the physician takes, it is important to note the source of the history. Several excellent recent references review these and other aspects of child sexual abuse.⁸⁰⁻⁸³

A normal physical examination is common in victims of child sexual abuse.^{84,85} In fact, diagnostic physical findings of sexual abuse are observed in fewer than 10% of victims, even with a history of penetration and when examined relatively soon after the abuse.⁸⁶

There are several potential explanations for this lack of physical findings.^{82,87-90} Characteristically, child sexual abuse gradually escalates in severity and involves nonviolent acts, in contrast to the physical violence often involved in adult sexual assaults. Certain types of sexual abuse (e.g., exposure to pornographic images, breast or genital fondling, and oral-genital contact) are more likely to leave no residual physical findings. A child's unsophisticated understanding of sexual acts may lead to misinterpretation of acts such as simulated intercourse. One also has to consider a child's understanding of common words such as "inside" with respect to the possibility of penetration or partial

Table 7. Selected Conditions Mistaken for Findings Due to Child Sexual Abuse⁹⁴

Normal variants or non-specific findings	Periurethral bands, hymenal tags, hymenal septa or septal remnants, intravaginal ridges, shallow hymenal clefts, midline findings such as anal tags or median raphe or avascular streaks, perianal erythema/increased pigmentation/venous dilation
Dermatologic	Irritant dermatitis, ecchymosis if due to accident or medical cause, Mongolian spots, vasculitis, infection (local or systemic), phytodermatitis, lichen sclerosis, bleeding or fissures due to dermatologic conditions such as seborrhea or atopic dermatitis, allergic dermatitis, insect bites, benign papillomatosis involving fossa navicularis
Congenital	Hemangioma of hymen/vulva/vagina/perineum, failure of midline fusion
Urethral	Prolapse, hemangioma, polyp, papilloma, caruncle, cyst, ureterocele, malignancy, ectopic ureter, bladder prolapse
Anal	Furuncle, fistula, anal canal eversion, anal laxity associated with neurologic disorders
Traumatic	Accidental straddle injuries, accidental splitting injury to midline structures associated with sudden forceful abduction of the legs, water under high pressure (e.g., water skiing), other accidental injury, hair tourniquet, labial fusion, female circumcision, penetrating anorectal/vaginal injury
Infectious	Mistaken bacteriologic/virologic identification, false positive non-culture test, non-STD bacterial anogenital infection (e.g., Group A streptococcus, Shigella), autoinoculation of warts

Key: STD = sexually transmitted disease

penetration. For example, a child may perceive pressure on the hymen or anus as penetration. Physical characteristics also affect the likelihood of injury and scarring after sexual abuse. Due to estrogen stimulation in adolescence, the hymen changes, becoming thicker and more elastic in nature. The anal opening also has elasticity, which allows for passage of large stools. Children with severe constipation may pass huge stools, yet usually have a normal perianal appearance or no more than self-limiting anal fissures. Children often do not disclose sexual abuse immediately; therefore, if tissue injury occurs it has a chance to heal before an examination. Furthermore, as hymenal injuries heal, they become less distinct and recognizable. (*See Figures 4a-b.*)

Approximately 40% of children seen for sexual abuse have significant mental health symptoms.⁹¹ The physician, therefore, needs to be able to provide appropriate referrals when indicated. Child protection issues should be addressed so that the child and siblings are not simply sent from the office or hospital back into the same abusive environment. Forensic evidence collection may be indicated, particularly in cases where there has been genital contact in the previous 72 hours, although the yield is lower compared to adults.⁹² Post-pubertal female victims need to be assessed for pregnancy, if indicated by history or examination. Documentation is critical in these cases, as already explained in a previous section.

Physical Examination. Although a general physical examination usually is unremarkable, it offers the physician an opportunity to develop rapport with the child or adolescent. The genital examination should be done only after explanation and preparation of both the child and parent. In prepubertal girls, supine or prone examining positions are utilized, with both positions

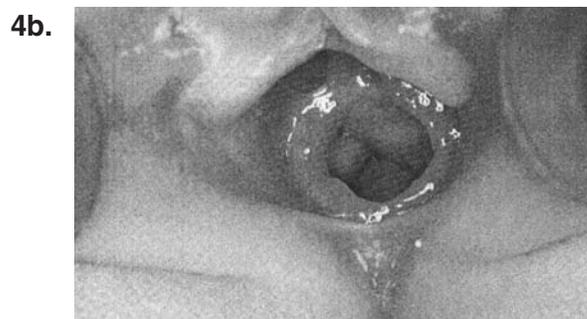
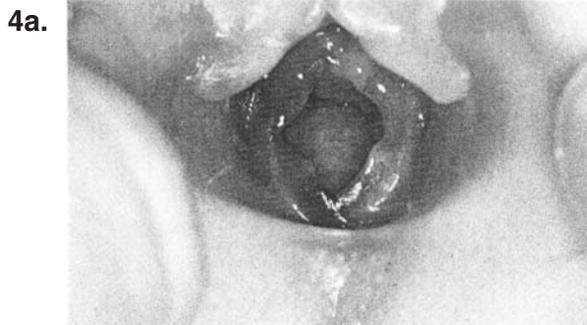
employed when there are concerning findings. Most referral centers utilize photocolposcopy for magnification of the external anogenital structures and documentation of the examination.

Children should not be restrained for the genital examination. This only provokes increased anxiety, repeats the sexual abuse in the child's eyes, and may make it less likely that the child will cooperate for future examinations. If a child refuses the genital examination, and there is no indication for an emergent examination, in most cases rescheduling the examination with attention to age-appropriate distraction techniques will suffice. If the child still refuses the genital examination, another option is to utilize sedation.⁹³ In some patients, a genital examination should not be deferred (e.g., when there is non-menstrual bleeding and major trauma). Such patients generally will require an internal examination, which in prepubertal girls should be done under anesthesia.

Relatively few abnormal genital and anal findings are associated with child sexual abuse.^{94,95} These are outlined in Table 6. Just as in any other area of medicine, there is a differential diagnosis to child sexual abuse.⁹⁶ (*See Table 7.*) As an example, Figure 5 shows an example of a patient with a prolapsed urethra initially suspected to be a genital injury due to sexual abuse.

Knowledge of prepubertal female anatomy is essential for accurate recognition and interpretation of findings. Unfortunately, in one study, nearly 40% of physicians were unable to identify the hymen from a colposcopic genital photograph of a normal prepubertal female.⁹⁷ In addition, examiners with less experience are less consistent in their interpretation of genital findings.⁹⁸ Another study showed that even pediatric emergency physicians' assessments did not correlate well with examiners who had specialized training in child abuse.⁹⁹

Figures 4a-b. Hymen Findings: Acute Trauma and Healing



4a. Almost 3-year-old with submucosal hemorrhages at the 6 o'clock position, and also from the 8- to 10 o'clock position. Traumatic shallow transection at the 9 o'clock position. **4b.** Follow-up examination 10 days later. Hymen appears well-healed, without any clear indication of previous trauma.

Used with permission from: Hegar A, et al. *Evaluation of the Sexually Abused Child*. New York: Oxford University Press; 1992:119.

Sexually Transmitted Diseases (STDs). STDs are relatively uncommon among child abuse victims. Indications for testing depend upon a variety of factors, such as history of symptoms in the patient, history of risk factors for or STDs in the alleged perpetrator or other victims, physical findings, and presence of other STDs.⁸⁰ At least in prepubertal females, the presence of vaginal discharge or abnormal genital findings appears predictive of gonorrhea and Chlamydia infections.¹⁰⁰

Accurate laboratory diagnosis of STDs is critical given the forensic implications of a positive test. Laboratory diagnosis of *Neisseria gonorrhoea* requires confirmatory testing, to prevent misidentification of other *Neisseria* species.¹⁰¹ In recent years, many laboratories have changed to non-culture diagnostic methods, including DNA amplification techniques for gonorrhea and chlamydia. However, these tests have not yet been approved by the U.S. Food and Drug Administration for use in prepubertal children and have the possibility of false positive tests. Given this and the forensic implications of a positive test, any positive result should be confirmed by culture, which is still the gold standard for diagnosis of these infections in children.¹⁰²

Non-sexual transmission of STDs is often a consideration. Table 8 summarizes the significance of potential STDs in chil-

Figure 5. Prolapsed Urethra



A 5-year-old female presented with unexplained, painless vaginal bleeding initially diagnosed as bruising to the hymen. Colposcopic photograph $\times 15$, supine knee-chest position, shows hemorrhagic mucosa of the prolapsed urethra (superior aspect) and smooth, normal-appearing posterior rim of hymen (inferior aspect).

dren. Persistent perinatal infection may cause difficulty in diagnosis for patients with condyloma, gonorrhea, Chlamydia, syphilis, and HIV.

Child Neglect

Though accounting for the largest number of referrals to CPS agencies, physicians are less likely to see children referred specifically for neglect issues. Definitions of child neglect vary depending upon whether one considers primarily issues such as actual or potential harm to the child, severity of the neglect, and frequency. Neglect is most commonly defined as acts of omission by the parental or caregiver that involve failure to provide necessities for the child.¹⁹

Dubowitz has proposed defining neglect by focusing on the effects to the child and as a condition in which the child's basic needs are not being met, regardless of cause.¹⁰³ The manifestations of child neglect are numerous, and depend upon the causes and risk factors. (See Table 9.) When neglect occurs depends upon whether there was harm or potential harm to the child, the degree of harm that occurred, and whether there are prior incidents suggesting a pattern.¹⁰³

Munchausen Syndrome by Proxy

Munchausen syndrome by proxy (MSBP) is a form of child abuse that involves persistently reported symptoms and illnesses in a child, actually fabricated by a parent (usually the mother).¹⁰⁴ The child may undergo multiple medical procedures and hospi-

Table 8. Sexually Transmitted Diseases and Child Sexual Abuse⁷⁸

STD	SEXUAL ABUSE	SUGGESTED ACTION
Gonorrhea ¹	Diagnostic ²	Report to CPS
Chlamydia ¹	Diagnostic ²	Report to CPS
Trichomonas vaginalis	Highly suspicious	Report to CPS
Condyloma acuminata ¹	Suspicious	Report to CPS
Herpes (genital)	Suspicious	Report to CPS ³
Bacterial vaginosis	Inconclusive	Medical management
Syphilis ¹	Diagnostic	Report to CPS
HIV ⁴	Diagnostic	Report to CPS

¹ If not perinatally acquired

² Use definitive diagnostic methods (i.e., culture with confirmatory tests if appropriate).

³ Unless clear history of autoinoculation

⁴ If not perinatally or transfusion acquired

Key: STD = sexually transmitted disease; CPS = child protective services

talizations, sometimes over years, until the diagnosis is suspected. The most common manifestations involve apnea, neurologic symptoms, bleeding, diarrhea, and vomiting. Diagnosis may be very difficult and require painstaking review of voluminous medical records. Multidisciplinary team consultation is critical for appropriate diagnosis and management. Covert video surveillance has shown how severe and potentially lethal this form of abuse can be.^{105,106} In recent years, there has been a movement to redefine MSBP as one form of factitious disorder.¹⁰⁷

The prevalence of deliberate suffocation of infants with recurrent apparent life-threatening events, whether considered MSBP or not, is significant and therefore deserves consideration in the differential diagnosis of such patients.^{108,109}

Outcomes of Child Maltreatment

A multitude of adverse outcomes are documented in children who experience abuse or neglect. Such children have a higher likelihood of behavioral and learning problems.¹¹⁰⁻¹¹¹ Mental health problems are common, especially post-traumatic stress disorder, reactive attachment disorder, depression, and anxiety disorders.¹¹² Incarcerated adults and juveniles, including those on death row, report a very high frequency of severe abuse during their childhood.^{113,114} Among females, sexual abuse and neglect during childhood are associated with prostitution as an adult.¹¹⁵

Unfortunately, the prognosis for SBS is not good.^{59,78,116-121} Of patients identified in the hospital setting, mortality is 12-30%. Survivors have a high chance of permanent disability, whether cognitive, motor, or behavioral. The prognosis remains guarded for infants who appear normal in their early years, as some have been found to have learning difficulties in the school years. It is possible that MRI spectroscopy in SBS may be a useful prognostic marker.¹²²

Studies show structural and functional abnormalities in the brain associated with child maltreatment and associated post-traumatic stress disorder.¹²³ During the first years of life, when

brain development is affected by one's experiences, there is evidence that the resulting effects on the brain of abuse and neglect can be irreversible.¹²⁴ Genetics also may play a role in explaining why some individuals exposed to child maltreatment are more resilient and do not show adverse effects as adults. For example, in a population of boys with a history of abuse, those with a genotype conferring high levels of the neurotransmitter-metabolizing enzyme monoamine oxidase A were less likely to develop antisocial behaviors as adults.¹²⁵

The Adverse Childhood Experiences Study, in which more than 9500 adults in the Kaiser Permanente health system were surveyed, has linked childhood abuse and other household dysfunction to several important public health problems.¹ These include alcoholism, drug abuse, depression, suicide attempt, smoking, sexual promiscuity, STD, physical inactivity, severe obesity, ischemic heart disease, cancer, chronic lung disease, and liver disease. The connection between adverse

childhood experiences (including abuse) and so many different risk-taking and health problems in adulthood likely relates to lifestyle and behavioral factors. Regardless, there is now established a clear connection between child maltreatment and many of today's most important societal and public health problems. The total costs, both direct and indirect, of child abuse and neglect in the United States have been estimated to exceed \$94 billion per year.² Child maltreatment, therefore, has to be considered one of our most important public health problems.

Prevention of Child Maltreatment

Federal research spending for child maltreatment has not kept pace with our understanding of it as a public health problem. In fiscal year 2000, federal spending for research on child abuse was \$22 per victim, compared with \$4665 per HIV/AIDS patient and \$4398 for each cancer patient.¹²⁶

With respect to primary prevention, home visitation by nurses during the first two years after delivery has been shown to have long-term positive effects, including a reduction in child abuse and neglect.¹²⁷ One hospital-based SBS prevention program in Buffalo, NY has shown very promising preliminary results.¹²⁸ All new parents are provided education regarding the dangers of shaking a baby, and the first two years of follow-up showed an 82% reduction in SBS cases.

Programs designed to prevent child sexual abuse have generally targeted potential victims, not potential perpetrators.¹²⁹ They tend to be provided in the preschool and early elementary school years, and have shown some promise. However, this approach has been criticized on moral grounds in that it puts the responsibility for prevention on children.

Primary care physicians who see children can certainly play a role in child abuse prevention. With respect to sexual abuse prevention, protocols and resources are available to teach parents and children protective behaviors. These can be adapted for use with anticipatory guidance in a primary care practice.¹³⁰

Table 9. Examples of Child Neglect from Various Perspectives¹⁰¹

CHILD

- Chronic disabilities
- Hunger-failure to thrive
- Unmanaged morbid obesity
- Extreme risk taking behavior

PARENT

- Drug/alcohol use
- Inability to provide adequate nutrition/nurturance—failure to thrive
- Noncompliance with health care
- Delay or failure to get health care
- Refusal of medical treatment

FAMILY

- Drug-exposed newborns and older children
- Ingestions
- Injuries
- Exposure to second-hand smoke, guns and domestic violence
- Failure to use car seats/belts
- Inadequate hygiene
- Inadequate clothing
- Inadequate food—failure to thrive

COMMUNITY

- Lack of affordable child care
- Emotional, behavioral and learning problems that are not addressed
- Educational needs not being met

SOCIETY

- Poverty
- Abandoned children
- Homeless children

Two situations commonly seen in association with serious physical abuse involve topics that often come up during health supervision visits for infants and toddlers. They are a young infant who won't stop crying, and an older infant or younger toddler who has a potty training accident. When these situations occur with a caretaker who has unrealistic expectations about infant and child behavior, the results can be disastrous for the child. Primary care physicians should keep these situations in mind as they provide anticipatory guidance for parents of children at these ages.

Child Abuse: The Physician's Role

The primary responsibility of the physician is suspecting the diagnosis of child abuse or neglect. Knowledge of the presenting historical features, symptoms, and signs, therefore, is essential. The physician must next be willing and able to report suspected abuse or neglect to the appropriate authorities. Assessment by a medical social worker, often available in the hospital setting, may

be invaluable in identifying risk factors and obtaining the psychosocial history.

Unfortunately, physicians do not always report cases of likely child maltreatment.¹³¹ Reasons include denial that abuse occurs; fear of legal involvement, reprisals, or losing patients from a practice; allegiance to family and parents over the child; a perception of poor quality of child protective services; and a lack of awareness of published literature and recommendations.

One common misperception is that reporting suspected child abuse requires a definitive diagnosis. As already explained, the requirement in all state reporting statutes is a *suspicion* of child abuse or neglect. It is not the physician's responsibility, and in fact is outside the physician's realm of expertise, to investigate such cases. A report of suspected child maltreatment is not a diagnosis or accusation. It is a call for additional investigation to help determine whether child abuse or neglect actually has occurred. The best investigators are those who want to find out what has happened to explain the child's findings, whatever the cause turns out to be.

A common question among health care professionals is whether and how to inform a family when one suspects child maltreatment and makes a report to child protective services. If the physician does inform the family and explain the reasons for the report, then the family is able to move beyond the initial shock of the report being made and to understand the reasons for it. The physician is being honest with the family and assuring his/her continued interest in the child's well being. An example of a useful approach in cases of suspected physical abuse is to first explain that the findings are or are suspected to be injuries. Then inform the parent that the findings/injuries are not adequately explained, therefore raising the question as to whether someone caused the injuries to the child. In such cases, a report to the child protective services agency will be made for two reasons. First, the physician is required by state law to report. Second, report is being done to assure that the child will return to a safe environment. The physician should not be accusatory when explaining the findings and need to report. It is not the physician's role to accuse. It is also important to remember that the person who brings the child to medical care may not be the perpetrator, and for that reason he or she may indeed not know what happened to the child.

Finally, physicians never should underestimate their importance when acting as an advocate for a child. One way that can be demonstrated is by helping to assure that a child suspected of being abused or neglected will be returning to a safe home environment when they leave the office, clinic, or hospital. Physicians should be willing to speak with investigators, answer their questions, and explain the reasons underlying their assessment and concerns. Contrary to popular belief, physicians are required to testify in court in only a minority of cases involving patients seen for suspected maltreatment.¹³² Ultimately, however, there may be involvement with the judicial system. The physician who is willing to act on behalf of a child suspected of being abused or neglected is one of the most important advocates the child can have.

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Primary Care Reports

CME Objectives

To help physicians:

- summarize the most recent significant primary care medicine-related studies;
- discuss up-to-date information on all aspects of primary care, including new drugs, techniques, equipment, trials, studies, books, teaching aids, and other information pertinent to primary care;
- evaluate the credibility of published data and recommendations; and
- describe the pros and cons of new testing procedures.

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Physician CME Questions

24. Which one of the following is a risk factor for child neglect?
 - a. Apgar scores less than 5
 - b. Day care
 - c. Maternal grandparents living in the home
 - d. Maternal substance abuse
 - e. Prenatal care beginning at two months of gestation
25. The most commonly reported form of child maltreatment is:
 - a. emotional abuse.
 - b. Munchausen syndrome by proxy.
 - c. neglect.
 - d. physical abuse.
 - e. sexual abuse.
26. Which of the following is required to file a report of child abuse?

- a. Evidence of injury from abuse
- b. Medical records
- c. Permission of the family
- d. Suspicion of abuse
- e. Witnessed incident of abuse

27. Of the following, which would be most likely in a 2-year-old who falls from a bed to the floor?
 - a. Bruising of the scalp
 - b. Depressed skull fracture
 - c. Linear skull fracture
 - d. Retinal hemorrhages
 - e. Subdural hematoma

Answer Key:

24. d
25. c
26. d
27. a

CME Instructions

Physicians participate in this continuing medical education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to evaluate their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material. *After completing this activity, you must complete the evaluation form that will be provided at the end of the semester and return it in the reply envelope provided to receive a certificate of completion.* When your evaluation is received, a certificate will be mailed to you.

In Future Issues:

Deep Venous Thrombosis