ABSTRACT

Pediatric abusive head trauma has a high rate of occurrence in the United States. It is a major cause of physical injury and death in children. Clinicians need to be aware of the risk factors and to be prepared to pursue a careful history and physical examination early in the evaluation period when care has been sought to avoid serious complications of injuries associated with abusive head trauma. Additionally, prevention strategies and support for parents to seek help to avoid child abuse are discussed.
Continuing Nursing Education Course Director & Planners:
William A. Cook, PhD, Director; Douglas Lawrence, MS, Webmaster;
Susan DePasquale, CGRN, MSN, FPMHNP-BC, Lead Nurse Planner

Accreditation Statement:
This activity has been planned and implemented in accordance with
the policies of NurseCe4Less.com and the continuing nursing education
requirements of the American Nurses Credentialing Center's
Commission on Accreditation for registered nurses.

Credit Designation:
This educational activity is credited for 2.5 hours. Nurses may only
claim credit commensurate with the credit awarded for completion of
this course activity.

Course Author & Planner Disclosure Policy Statements:
It is the policy of NurseCe4Less.com to ensure objectivity,
transparency, and best practice in clinical education for all continuing
nursing education (CNE) activities. All authors and course planners
participating in the planning or implementation of a CNE activity are
expected to disclose to course participants any relevant conflict of
interest that may arise.

Statement of Need:
The statistics, risk factors and clinical characteristics associated with
pediatric abusive head trauma are necessary for health providers to
detect and manage this injury, and to promote prevention.

Course Purpose:
To provide nurses with an overview of the recognition and prevention
of pediatric abusive head trauma.
Learning Objectives:
1. Identify risk factors for pediatric abusive head trauma.
2. Identify commonly reported signs of pediatric abusive head trauma.
3. Identify injuries that are common to pediatric abusive head trauma.
4. Identify the mechanism(s) of injury of pediatric abusive head trauma.
5. Discuss the process of detection and diagnosis of pediatric abusive head trauma.

Target Audience:
Advanced Practice Registered Nurses, Registered Nurses, Licensed Vocational Nurses and Associates

Course Author & Director Disclosures:
Dana Bartlett, RN, BSN, MA, MSN, William S. Cook, PhD, Douglas Lawrence, MS, Susan DePasquale, CGRN, MSN, FPMHNP-BC - all have no disclosures.

Acknowledgement of Commercial Support: There is none.

Activity Review Information:
Reviewed by Susan DePasquale, CGRN, MSN, FPMHNP-BC.

Release Date: 11/11/2014    Termination Date: 11/11/2017

Please take time to complete the self-assessment Knowledge Questions before reading the article. Opportunity to complete a self-assessment of knowledge learned will be provided at the end of the course.
1. True or false: Very few cases of pediatric abusive head trauma go undetected.
   a. True
   b. False

2. Two mechanisms of injury that can explain pediatric abusive head trauma are:
   a. Shaking and impact force.
   b. Impact force and malnutrition.
   c. Shaking and a coincidental systemic infection.
   d. Developmental delays and short, accidental falls.

3. Which of the following increases the risk for pediatric abusive head trauma?
   a. Female gender
   b. Age > 5 years
   c. Male gender
   d. Premature birth

4. Which of the following increases the risk for pediatric abusive head trauma?
   a. Developmental delays
   b. Chronic otitis media
   c. Female gender
   d. Age < one year

5. True or false: Children who have abusive head trauma often have evidence of previous abuse.
   a. True
   b. False
6. Which of these injuries is commonly caused by pediatric abusive head trauma?
   a. Retinal hemorrhages
   b. Pneumothorax
   c. Skull fracture
   d. Ruptured spleen

7. Which of these injuries commonly occurs with pediatric abusive head trauma?
   a. Liver damage
   b. Rhandomyolysis
   c. Subdural hematoma
   d. Facial fractures

8. Which of these injuries is commonly associated with pediatric abusive head trauma?
   a. Oral trauma
   b. Esophageal trauma
   c. Scalp lacerations
   d. Rib fractures

9. Children ≤ 24 months of age who may have suffered abuse should:
   a. have cardiac enzymes and serum CK measured.
   b. have a skeletal survey and a CT or MRI scan of the head.
   c. have a cardiac echocardiogram.
   d. have a skull x-ray and a chest x-ray.

10. True or false: Pediatric abusive head trauma is always accompanied by external signs of trauma.
    a. True
    b. False
Introduction

Pediatric abusive head trauma, once commonly known as and still occasionally called the shaken baby syndrome, is a form of child abuse that can result in significant morbidity and mortality. The traditional explanation for pediatric abusive head trauma (hereinafter, simply referred to as abusive head trauma) was that violent shaking of the child or infant by an adult caused shearing and breaking of blood vessels in the brain and the eyes. However, many authorities feel that shaking alone cannot account for the damage seen in cases of abusive head trauma. The exact mechanism or mechanisms of injury are not known, but the injuries incurred are most likely caused by impact force, shaking, or a combination of the two.

The peak incidence of abusive head trauma appears to be in children less than one year of age, and frequently the victims are between the ages of 2 to 4 months. Most of the victims and most of the perpetrators are male. The exact incidence of abusive head trauma is not known, but it is certainly under-diagnosed and under-detected. However, there are no doubts about the seriousness of this type of child abuse. Intracranial bleeding, significant ocular damage, multiple fractures, and other serious injuries are very common consequences of abusive head trauma. In addition, the mortality rate of abusive head trauma has been estimated to be as high as 25% and many of the survivors are left with permanent and significant disabilities.

Detection of pediatric abusive head trauma can be very difficult and requires a high index of suspicion. There are some injuries that are considered to be essentially diagnostic for abusive head trauma but in many cases the clinical presentation is non-specific, there are no
visible signs of injury, and there are no witnesses to the event. Improving detection rates is critically important, as the research has shown that children who are abused this way will almost always be abused again.

This course provides an overview of the recognition and prevention of pediatric abusive head trauma. Specific topics include the statistics of abusive head trauma, mechanisms of injury, etiology of and risk factors for abusive head trauma, the clinical characteristics and specific injuries associated with abusive head trauma, detection and diagnosis of this injury, and management and prevention issues.

**Statistics Of Child Abuse**

Child abuse includes abandonment, emotional abuse, neglect, physical abuse, sexual abuse, and substance abuse, and it is a significant problem in the United States. In 2011, 3.4 million referrals were made to child protective services.\(^1\) The annual incidence of abusive head trauma has been estimated to be approximately 24-34 cases per 100,000 children one year of age or younger.\(^2\) These statistics by themselves are very disturbing, yet the actual number of children who are abused is likely much higher\(^1\) as not all cases are reported and/or detected, and the standards for reporting differ.

Definitions of child abuse vary and this has legal, medical, and social implications. For example, the National Incidence Study (a U.S. government directed assessment of child abuse and neglect) assesses the

---

**Child protective services are the local, county, and state agencies that intervene in cases of child abuse.**
prevalence of child abuse using the Harm Standard and the Endangerment Standard. The Harm Standard requires that an act or omission must cause demonstrable harm to be considered abuse while the Endangerment Standard only requires that a child be endangered by abuse or neglect. The definition that will be used here is from the Federal Child Abuse Prevention and Treatment Act. Child abuse, at minimum is:

“Any recent act or failure to act on the part of a parent or caretaker which results in death, serious physical or emotional harm, sexual abuse or exploitation; or an act or failure to act which presents an imminent risk of serious harm.”

Physical abuse of children is less prevalent than many of the other forms of child abuse. Of the over three million reports of child maltreatment received by child protective services approximately 18% of these involve physical abuse. Tragically, many of these cases of physical abuse involve head trauma.

Abusive head trauma is a leading cause of serious, traumatic brain injury and death in children two years of age and younger in the United States. Abusive head trauma has been estimated to be the cause of 50%-80% of the deaths attributable to head trauma in this age group and mortality rates in abusive head trauma have been reported to be between 15%-25%. Keenan et al., (2004) found that almost 39% of children who had an inflicted brain injury required cardiopulmonary resuscitation (CPR), over 31% had a loss of consciousness, and almost 49% had a seizure. The initial injury, if the child survived, can often cause permanent and serious behavioral,
neurological, and physical impairments\textsuperscript{7} and approximately one-third of all children who are victims of abusive head trauma are severely disabled.\textsuperscript{10}

The tragedy of abusive head trauma is compounded by missed diagnoses and repetitive injuries. Jenny \textit{et al.}, (1999) found in their retrospective study of head trauma that 31\% of cases of abuse head trauma were not accurately diagnosed by the physician and 28\% of children were re-injured after that missed diagnosis.\textsuperscript{11} These findings have been reaffirmed by later researchers\textsuperscript{12} and it has also been shown that as many as 45\% of children who have suffered abusive head trauma had been previously abused.\textsuperscript{12,13}

\textbf{Pediatric Abusive Head Trauma Defined}

As mentioned in the introduction, abusive head trauma was originally called shaken baby syndrome. The term shaken baby syndrome is still used, but the American Academy of Pediatrics has recommended it no longer be used and the term abusive head trauma used in its place.\textsuperscript{14} The Academy pointed out that \textit{shaking} is a mechanism of injury of abusive head trauma. However, the Academy also wanted clinicians to be aware that shaking is not the only way this injury can be inflicted. Blunt force trauma alone can cause abusive head trauma or there can be a combination of forces. Clinicians trying to determine if a child may be suffering from abusive head trauma or if head trauma was accidental or inflicted could be mislead if they believe shaking to be the sole mechanism of injury of abusive head trauma.\textsuperscript{14,15}

The Centers for Disease Control and Prevention (CDC) has defined pediatric abusive head trauma as:\textsuperscript{16} ... \textit{an injury to the skull or
intracranial contents of an infant or young child (< 5 years of age) due to inflicted blunt impact and/or violent shaking; unintentional injuries resulting from neglectful supervision and gunshot wounds, stab wounds, and penetrating trauma are excluded from this definition.\textsuperscript{16}

Recognizing and writing about the patterns and consequences of child physical abuse of patterns was first done by Ambrose Tardieu in France in the 1800s.\textsuperscript{17} In the United States, Dr. John Caffey in 1946 was the first to publish a systematic study of clinical and radiologic evidence that suggested a syndrome of child physical abuse.\textsuperscript{18} However, although Caffey indicated that he felt the pattern of injuries he described was caused by deliberate abuse, he only suggested it and did not conclusively state that abuse was the cause. It was not until 1962 that Kempe \textit{et al.}, unequivocally described and labeled child physical abuse as abuse.\textsuperscript{19} The authors’ term for this was \textit{battered-child syndrome}.

Guthkelch’s (1971)\textsuperscript{20} and Caffey’s (1972)\textsuperscript{21} research on the topic of child physical abuse implicated shaking as the primary mechanism of injury and during that time abusive head injury was occasionally referred to as infant whiplash injury. The term shaken baby syndrome was first used by Ludwig and Warman in 1984\textsuperscript{22} and subsequently replaced by the terms abusive head trauma or pediatric abusive head trauma.\textsuperscript{23,24}

**Mechanisms Of Pediatric Abusive Head Trauma**

The traditional term for pediatric abusive head trauma, shaken baby syndrome, was first used in a case series study of 20 infants who had suffered physical abuse\textsuperscript{22} and these authors, and several others who
had written previously on the subject, assumed that shaking was the primary mechanism of injury that explained the syndrome. Subsequently, the medical community accepted both the term shaken baby syndrome and the idea that violent shaking was the sole cause of the neurologic, ocular, and other damage caused by this abuse. This belief by the medical community is no longer the case. Violent shaking causes rotation and acceleration-deceleration of the head and brain; this can be of sufficient force to cause abusive head trauma.

An infant has a proportionally large head and relatively weak neck muscles and the sudden, intense movement of the head that occurs when an infant is shaken can cause shearing of blood vessels in the brain and the eyes. However, there is considerable controversy as to whether shaking alone can mechanistically explain the damage of abusive head trauma, or if shaking plus impact are needed. As early as 1988, Duhaime had performed biomechanical studies and concluded the following: 

- the force of impact was far greater than the force of shaking;
- shaking was not necessary to produce rotational forces;
- shaking could not produce sufficient force to cause the pathological and radiological evidence of abusive head trauma.

In 2010 Dias wrote that no convincing argument had been advanced that supported shaking as the primary mechanism of injury in abusive head trauma. Herman et al., (2010) wrote:
“An accumulating body of evidence, however, supports the idea that either mechanism, shaking alone or shaking with impact, can produce the injuries that are observed clinically.”

However, Christian et al. (2009) concluded that “. . . all the models and theories (of abusive head trauma) have known limitations . . .”. Once the initial, primary injury from mechanical forces has occurred, secondary mechanisms of injury such as hypoxia-ischemia, inflammation, or hypoperfusion may begin. These secondary mechanisms of injury appear to be more common in inflicted head trauma in children than in accidental head trauma; and, the outcome for the infant is likely to be very poor if hypoxia and ischemia are present.

Risk Factors Of Pediatric Abusive Head Trauma

There are specific patient, caregiver, and environmental factors that increase the risk for abusive head trauma. Knowing what these risk factors are helps the clinician to determine whether they are present, and forms a critical part of the assessment of abusive head trauma. Clinicians often speak of the index of suspicion when they are trying to make a diagnosis. This simply means that the clinician uses objective data to determine what disease, illness, or injury is most likely to be responsible for the patient’s clinical condition. For example, if the patient is 69 years old and has shortness of breath, cyanosis, rales, and a past medical history of hypertension and myocardial infarction, the index of suspicion would be high for congestive heart failure and low for asthma.
The clinician should consider the need for assessment of pediatric abusive head trauma if:

- the child has an acute or a chronic illness or injury and there is no adequate explanation or an inconsistent explanation;
- the child has a severe head injury or other major trauma that is reported to have happened because of a short fall or minor accident;
- there is an unexplained head injury in a child who had previously been well;
- circumstances surrounding the injury are accompanied by risk factors and certain patterns of injury that are associated with abusive head trauma.

Of course, the necessary data may not be available or the data that is available is equivocal. In cases of abusive head trauma, physical signs or radiologic findings that are typically considered to be diagnostic of abusive head trauma may be absent; or the results of examination, X-rays, and scans may be too general and non-specific.

Because it is critically important to make an early and accurate diagnosis of abusive head trauma, nurses and other health care professionals must be aware of the risk factors associated with it. Risk factors associated with abusive head trauma are outlined in Table 1 below. ¹⁰
Table 1: Factors Associated with Increased Risk for Abusive Head Trauma

| Caregiver mental health disease |
| Caregiver substance abuse |
| Inconsolable crying |
| Intimate partner violence |
| Low socioeconomic status |
| Male caregiver |
| Male gender of the child |
| Previous abuse |
| Young age of the child |
| Young maternal age |

For some of these factors the association between the risk factor and abusive head trauma is strong and consistent. Many authors have noted that a child’s age of less than one year is consistently associated with abusive head trauma,\(^5,\)\(^30-34\) that males are more likely than females to be victims of abusive head trauma,\(^5,\)\(^31-33,35\) and males are the perpetrator of abusive head trauma more often than females.\(^15\)

Evidence of prior abuse is also a common finding.\(^32\) Of particular interest is the issue of crying. Abusive head trauma is much more likely to occur in children less than one year of age, and inconsolable infant crying is common during this period of a child’s development. The crying can be prolonged, unpredictable, accompanied by other behaviors that can be upsetting to caretakers, and, as the term suggests, the infant cannot be consoled. Several authors have found that inconsolable crying is associated with abusive head trauma.\(^36-38\) Significant traumatic injuries in a child who does not walk or is in the
pre-cruising (walking with assistance) stage of development are also highly unlikely, and indicative of abusive head trauma.

There are also risk factors specific to the pediatric brain and pediatric anatomy that contribute to the neurological and ocular injuries caused by abusive head trauma.\textsuperscript{15,39}

- An infant’s head is relatively large and unstable when compared to its body. This feature of infant anatomy can mean that if an infant is vigorously shaken, the head and the brain can rapidly accelerate and decelerate.
- An infant’s brain matter is relatively soft and has high water content, making it softer and susceptible to injury.
- An infant’s skull is soft and pliable so force is more easily transmitted to the brain.
- The base of an infant’s skull is relatively flat and this allows for more brain movement inside the skull.
- An infant’s neck muscles are relatively weak and this allows for greater movement of the head in response to force.
- A relatively high cerebral blood flow increases the potential for bleeding and swelling in the brain.

**Clinical Presentation Of Pediatric Abusive Head Trauma**

Abusive head trauma should be considered as a possibility in every child less than two years of age who has neuro-trauma or a neurological abnormality.\textsuperscript{47} Abusive head trauma is detected and diagnosed through a combination of awareness or suspicion of the possibility in a given circumstance, a carefully performed history and physical examination, consultations (i.e., neurology, ophthalmology), characteristic physical findings, and appropriate diagnostic testing.
Detecting and diagnosing abusive head trauma is difficult, and for many reasons the diagnosis of this trauma requires a high index of suspicion. Some of the difficulties that hinder detection and diagnosis of abusive head trauma are further discussed below.

Risk factors can be helpful in identifying children who are victims of abusive head trauma. Although some of these are reliable predictors of the possibility of abusive head trauma they are non-specific, i.e., male gender and age less than one year (and they do not account for all cases). There are always exceptions to identified risk factors of abusive head trauma. Using these risk factors must be done with caution to avoid stereotyping, over-diagnosing, and underdiagnosing. Of significance, there is a wide range of signs that have been observed in children who have suffered abusive head trauma, ranging from mild to life-threatening. The clinical presentation is often non-specific. In many cases of abusive head trauma there is no reported history of trauma. The precipitating event is seldom witnessed, and the perpetrator and/or the adult who brings the child for medical attention may not be truthful about how the injury occurred.

The neurological examination may be normal, or the child may have evidence of severe brain injury. Many children do not have external evidence of injury. King et al., and Keenan et al. noted that 54% and 40%, respectively, of the children they examined who had abusive head trauma had no external signs of injury.

Clearly there are significant challenges in detecting and diagnosing abusive head trauma. Because of the high morbidity and mortality rate associated with abusive head trauma, and the high risk that infants
who are abused once will be abused again, it is critically important that this diagnosis not be missed. The risk factors associated with abusive head trauma are helpful in this respect, but they are limited and can only help as a guide for the clinician point. Its important for the clinician to keep in mind that the clinical presentation of abusive head trauma varies significantly and is non-specific; and, the injuries that are considered to be part of the “typical” presentation of abusive head trauma are not always present and may be caused by accidental trauma, diseases, etc. Table 2, below, outlines differential diagnosis in the determination of abusive head trauma.\(^\text{10}\)

### Table 2: Differential Diagnosis for Abusive Head Trauma

<table>
<thead>
<tr>
<th>Accidental trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign extra-axial fluid of infancy</td>
</tr>
<tr>
<td>Benign external hydrocephalus</td>
</tr>
<tr>
<td>Birth trauma</td>
</tr>
<tr>
<td>Bleeding disorders</td>
</tr>
<tr>
<td>Metabolic diseases</td>
</tr>
</tbody>
</table>

There are patterns of injury and a few clinical signs that are considered essentially pathognomonic for abusive head trauma. Apnea, bruising of the ears, neck, or torso, cerebral edema, certain types of skull fractures, encephalopathy, long bone fractures, metaphyseal fractures, skull fractures plus intracranial injury, retinal hemorrhages, and subdural hemorrhage have all been strongly associated with, and in some cases highly sensitive and specific for, abusive head trauma.\(^{2,42,44}\) Retinal hemorrhages, subdural hemorrhage, fractures,
and encephalopathy are considered to be the common injuries of abusive head trauma, and each these will be discussed individually.

**Retinal Hemorrhage and Other Ocular Damage**

Retinal hemorrhages are very common in children who have abusive head trauma. One review noted the presence of retinal hemorrhages in almost 85% of children who had been diagnosed with abusive head trauma, and other authors have confirmed the high incidence of this ocular damage in these cases. Retinal hemorrhages also have a high specificity and high predictive value for abusive head trauma. In addition, they are rarely caused by accidental head trauma. Given that fact, and the high incidence, high specificity, and high predictive value, retinal hemorrhages are felt to be almost pathognomonic for abusive head trauma in very young children and infants.

The absence or presence of retinal hemorrhages cannot be the sole criteria for diagnosing abusive head trauma. Agrawal et al. (2012) found a 15% prevalence of retinal hemorrhages in critically ill children, therefore, the absence or presence of ophthalmic findings should only be considered as part of the diagnostic picture and must be used in context. Table 3 below lists the differential diagnosis for retinal hemorrhage.

**Table 3: Differential Diagnosis for Retinal Hemorrhage**

<table>
<thead>
<tr>
<th>Anemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide poisoning</td>
</tr>
<tr>
<td>Cardio-pulmonary resuscitation</td>
</tr>
<tr>
<td>Genetic syndromes</td>
</tr>
</tbody>
</table>
Glutaric aciduria - autosomal recessive metabolic disorder
Hematologic conditions, coagulopathies, and other bleeding disorders

Hypoxia
Hypo- hypertension
Infections
Intracranial hemorrhage
Perinatal retinal hemorrhage
Sepsis
Sudden Infant Death Syndrome
Tumors
Unintentional head injury
Vasculitis

Other ocular damage that can be caused by abusive head trauma includes, but is not limited to, hemorrhage of the optic nerve sheath, hemorrhage of the vitreous sheath, papilledema, perimacular folding, and retinoschisis. These are less common than retinal hemorrhage but can be highly more specific for abusive head trauma, i.e., perimacular folds and retinoschisis. Papilledema has been described a late finding and associated with a poor prognosis.

The term retinoschisis means a splitting of the retina. A perimacular fold is a doubling over (folding) in the macula, the central part of the retina. Papilledema is defined as optic disc swelling caused by increased intracranial pressure.
**Subdural Hemorrhage**

Subdural hemorrhages have been reported in 77%-90% of patients who have suffered abusive head trauma. A serious intracranial injury is rarely caused by low impact trauma, and a subdural hematoma is a very unusual occurrence in children unless the child was involved in a motor vehicle accident or a high fall. Short, accidental falls rarely cause serious harm or death in children.

The presence of a subdural hemorrhage in an infant or child should prompt clinicians to investigate the possibility of abusive head trauma. Intraparenchymal bleeding, epidural hemorrhage, subarachnoid hemorrhage or some combination of these can also be caused by abusive head trauma. A subdural hemorrhage is a collection of blood between the dura mater and the arachnoid mater. The dura mater is the outermost of the three meninges (fibrous membranes) that surround the brain and the spinal cord, and the arachnoid mater in the middle meninge.

A subarachnoid hemorrhage is a collection of blood between the arachnoid meninge and the innermost meninge, the pia mater. As with retinal hemorrhages, a subdural hematoma is highly suggestive of, but not diagnostic for abusive head trauma. Clinicians must consider other possible causes for this injury:

> “While the majority of the available literature seems to accept that the presence of any unexplained SDH (subdural hematoma) or SDH not related to a comorbid condition in a young child should raise the suspicion of NAT (non-accidental trauma), the data supporting this conclusion are difficult to interpret.”

55
Table 4 includes a list of possible conditions for the clinician to consider in the differential diagnosis of subdural hematoma.\textsuperscript{10,40}

**Table 4: Differential Diagnosis of Subdural Hematoma**

<table>
<thead>
<tr>
<th>Birth trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulopathies</td>
</tr>
<tr>
<td>Genetic syndromes</td>
</tr>
<tr>
<td>Infections</td>
</tr>
<tr>
<td>Metabolic diseases</td>
</tr>
<tr>
<td>Trauma</td>
</tr>
<tr>
<td>Tumors</td>
</tr>
</tbody>
</table>

**Fractures**

Fractures are not uncommon in cases of abusive head trauma.\textsuperscript{56} Rib fractures, long bone fractures, metaphyseal fractures, radius and ulna fractures, and tibia or fibula fractures appear to be typical sites of injury; and, rib fractures are mentioned most often in the literature as being associated with abusive head trauma\textsuperscript{2,10,42,57-61}

Fractures are a common childhood injury, but multiple fractures (especially of the ribs) appear to occur more often as a result of abuse than from accidental trauma. A fracture in a child less than one year of age is often caused by abuse.\textsuperscript{59} Skull fractures are uncommon in cases of abusive head trauma.\textsuperscript{2,9,15,42,55,60,62}

**Encephalopathy**

Encephalopathy is defined as a disorder or disease of the brain. Children who have sustained abusive head trauma present with a wide range of behavioral and neurological problems. Some of these are
relatively minor, such as the child might be irritable or lethargic. Others are very severe. The victims of pediatric abusive head trauma may suffer from epilepsy, seizures, motor weakness, and visual, cognitive, and sensory impairments, and one author estimated that neurological damage sustained as a result of pediatric abusive head trauma was permanent in more than 80% of the victims. It is also possible that a child who has suffered pediatric abusive head trauma may appear to be normal and the trauma is found after computed tomography (CT) or magnetic resonance imaging (MRI) scanning.

**Diagnostic Testing And Consultation**

Differentiating between accidental injuries and inflicted trauma is difficult in the case of abusive head trauma. Detecting abuse is also very difficult in the absence of obvious signs and symptoms and/or a confession by a parent or a caretaker. Child abuse and pediatric abusive head trauma are relatively common, but the detection rate of these problems by health care facilities is presumed to be very low, even when health care professionals have been trained to use systematic screening tools designed to detect abusive head trauma. Diagnostic testing, i.e., X-rays, scans, and laboratory testing, and neurologic and ophthalmologic consultations, can be very helpful in detecting cases of abusive head trauma, and some of these are considered mandatory.

The American College of Radiology recommends that children who are 24 months of age or younger who may have suffered physical abuse should receive a skeletal survey. The skeletal survey includes: 1) frontal and lateral views of the skull; 2) lateral views of the cervical spine (if not included on the lateral view of the skull) and the
thoracolumbosacral spine; and, 3) single frontal views of the long bones, chest, and abdomen.\textsuperscript{70} Oblique views of the ribs should also be done; and, for the best quality and diagnostic accuracy, separate views of each arm, forearm, foot, hand, leg, and thigh should be done.\textsuperscript{70} Bone scans should be done if the X-rays are negative but the clinical examination suggests a high index of suspicion for abuse.\textsuperscript{70}

Computerized axial tomography and magnetic resonance imaging scanning should be used to detect intracranial damage such as a subdural hematoma.\textsuperscript{40} If the child has a skull fracture or clinical signs and symptoms of intracranial injury a CT scan should be done immediately.\textsuperscript{70} An MRI should be done if the CT scan does not detect damage that requires immediate surgical intervention but the clinician has determined that further assessment is necessary.\textsuperscript{70} If the child has no physical or clinical signs of intracranial injury but there is reason to believe that the child may have suffered abusive head trauma, it is better to err on the side of caution and perform a CT scan or MRI scan as “... clinicians should have a relatively low threshold for performing either CT or MRI of the head in children with suspected abuse.”\textsuperscript{70}

Laboratory tests that may be useful are a complete blood count and (possibly) coagulation studies,\textsuperscript{71,72} and a urine drug screen to detect the presence of illicit drugs. Consultations with a pediatric neurologist and a pediatric ophthalmologist should be considered mandatory.

**Management And Prevention**

Nurses have the responsibility to document the clinical condition of the child who may have suffered abusive head trauma, provide care to the
child, and report confirmed or suspected cases to the appropriate agencies. Precise and detailed documentation is obviously critically important. Deciding that abusive head trauma has or has not occurred is a process that requires the involvement of many people. Determining that such an injury has occurred would not be the sole responsibility of the nurse or within the scope of practice of the nurse; the safety of the child and reporting abuse are primary nursing responsibilities.

A comprehensive discussion about when, how, and to whom to report confirmed or suspected abusive head trauma is beyond the scope of this learning module. However, nurses must report confirmed and suspected cases, child protective services should be notified, and a social service consultation obtained. Because the consequences of abusive head trauma are so serious, it is recommended that these referrals be made as soon as possible. All states require nurses and other health care professionals to report child abuse; the state by state specifics for mandatory reporting, i.e., who is required to report, when to report and to whom can be found using the online resource: Child Welfare Gateway. U.S. Department of Health and Human Services. Mandatory Reporters of Child Abuse. 2014.73 https://www.childwelfare.gov/systemwide/laws_policies/statutes/mandda.pdf.

Specific treatment will depend on the injuries sustained and the appropriate medical and surgical consultations should be obtained. Pediatric abusive head trauma is likely to happen in certain circumstances and there are risk factors that appear to increase the
possibility of its occurrence. But even if these circumstances and risk factors are present, pediatric abusive head is not inevitable. Prevention programs are a key part of the approach to the problem of abusive head trauma and there is evidence that they can be successful.

Dias et al. (2005) and Altman et al. (2001) provided educational programs to parents and caretakers that focused on infant crying, coping strategies, and the dangers of abusive head trauma; and, the authors concluded that these interventions reduced the incidence of abusive head trauma. Prevention programs have also been shown to increase parent and caretaker awareness of the problem of abusive head trauma and increase awareness of coping strategies to deal with inconsolable crying.

The Period of Purple Crying® is a prevention program that has been assessed and proven successful at increasing awareness of abusive head trauma and the use of coping strategies for inconsolable crying. Purple is an acronym that describes the features of inconsolable crying:

- Peak of crying (the pattern slowly reaches a peak)
- Unexpected crying
- Resists soothing
- Pain-like face (the infant appears to be in pain)
- Long-lasting (crying can last for 5 hours or more)
- Evening (the infant typically cries in the evening or at night)

Parents who are educated about these aspects of inconsolable crying will, hopefully, be less likely to harm their children and more likely to
use effective coping strategies or seek help. More information about The Period of Purple Crying® and be found on the organization’s website, www.purplecryinginfo.org.

**SUMMARY**

Abusive head trauma is a significant cause of infant and child morbidity and mortality. Abusive head trauma was originally called shaken baby syndrome. It was thought that the primary mechanism of injury was violent shaking by an adult that caused rotational forces and acceleration-deceleration of the head, resulting in shearing and breaking of blood vessels in the brain and eyes. In recent years the validity of this theory has been intensely debated and the current thinking is that shaking is unlikely to be the sole mechanism of injury in abusive head trauma; and, the American Academy of Pediatrics discourages use of the term shaken baby syndrome.

The presentation of abusive head trauma is very variable. The victim may not have external evidence of injury or there may be clear signs of trauma. Some children who have suffered abusive head trauma may appear [*relatively*] well while other may be apneic and comatose. In addition, the abuse is seldom witnessed and the perpetrator is unlikely to admit guilt. As a result of these issues, detecting and diagnosing abusive head trauma is very difficult. Detection and diagnosis is critical as the evidence clearly shows that abuse is seldom an isolated occurrence. If the abuse has happened once it will likely happen again.

However, knowledge of the risk factors and injuries that are associated with abusive head trauma can be helpful in this regard. Children less than one year of age and males are more likely to be victims and
intracranial bleeding, retinal hemorrhages, and certain types of fractures are common. Although risk factors and patterns of injury can be very suggestive of abusive head trauma none of them alone are diagnostic of this trauma. The diagnosis of abusive head trauma requires careful consideration of all of the evidence. The specific tests that are needed will depend on the circumstances of each case, but in most instances of suspected abusive head trauma a skeletal survey, a CT scan or MRI scan of the head, and consultations with a neurologist and an ophthalmologist would be considered mandatory.

Specific treatment will depend on the injuries sustained and the appropriate medical and surgical consultations should be obtained. Nurses are required by law to report of confirmed or suspected cases of abusive head trauma: child protective services and a social service should be notified.

Please take time to help the NURSECE4LESS.COM course planners evaluate nursing knowledge needs met following completion of this course by completing the self-assessment Knowledge Questions after reading the article. Correct Answers, page 30.
1. True or false: Very few cases of pediatric abusive head trauma go undetected.
   a. True
   b. False

2. Two mechanisms of injury that can explain pediatric abusive head trauma are:
   a. Shaking and impact force.
   b. Impact force and malnutrition.
   c. Shaking and a coincidental systemic infection.
   d. Developmental delays and short, accidental falls.

3. Which of the following increases the risk for pediatric abusive head trauma?
   a. Female gender
   b. Age > 5 years
   c. Male gender
   d. Premature birth

4. Which of the following increases the risk for pediatric abusive head trauma?
   a. Developmental delays
   b. Chronic otitis media
   c. Female gender
   d. Age < one year

5. True or false: Children who have abusive head trauma often have evidence of previous abuse.
   a. True
   b. False
6. Which of these injuries is commonly caused by pediatric abusive head trauma?
   a. Retinal hemorrhages
   b. Pneumothorax
   c. Skull fracture
   d. Ruptured spleen

7. Which of these injuries is commonly occurs with pediatric abusive head trauma?
   a. Liver damage
   b. Rhandomyolysis
   c. Subdural hematoma
   d. Facial fractures

8. Which of these injuries is commonly associated with pediatric abusive head trauma?
   a. Oral trauma
   b. Esophageal trauma
   c. Scalp lacerations
   d. Rib fractures

9. Children ≤ 24 months of age who may have suffered abuse should:
   a. have cardiac enzymes and serum CK measured.
   b. have a skeletal survey and a CT or MRI scan of the head.
   c. have a cardiac echocardiogram.
   d. have a skull x-ray and a chest x-ray.

10. True or false: Pediatric abusive head trauma is always accompanied by external signs of trauma.
    a. True
    b. False
Correct Answers:

1. B
2. A
3. C
4. D
5. A
6. A
7. C
8. D
9. B
10. B

Footnotes:


The information presented in this course is intended solely for the use of healthcare professionals taking this course, for credit, from NurseCe4Less.com. The information is designed to assist healthcare professionals, including nurses, in addressing issues associated with healthcare.

The information provided in this course is general in nature, and is not designed to address any specific situation. This publication in no way absolves facilities of their responsibility for the appropriate orientation of healthcare professionals. Hospitals or other organizations using this publication as a part of their own orientation processes should review the contents of this publication to ensure accuracy and compliance before using this publication.

Hospitals and facilities that use this publication agree to defend and indemnify, and shall hold NurseCe4Less.com, including its parent(s), subsidiaries, affiliates, officers/directors, and employees from liability resulting from the use of this publication.

The contents of this publication may not be reproduced without written permission from NurseCe4Less.com.