Emergency Department Non-Accidental Trauma (NAT) Guideline

All children suspected of non-accidental trauma will have a complete work-up including a complete history and physical exam a focus on injuries and explanation for the injuries.

Major Areas of Evaluation:

1. A complete history (document from/by whom & if it contradicts prior story)
   a. Including review of prior PCP (if available), ED, and inpatient records as well as prior radiologic studies performed at outside hospitals (if available) to look for sentinel injuries

2. Head to toe physical exam with particular attention to:
   a. Growth parameters
   b. Thorough skin exam, including scalp and hair (undress patient completely)
   c. Palpation of legs, arms, hands, feet and ribs to feel for crepitus or deformities
   d. Complete neurologic examination
   e. Oral examination with attention to the lips, tongue, buccal mucosa, frenula, palate and teeth
   f. Auricle exam
   g. Genitalia examination

3. Head Imaging
   a. Infants < 12 months of age should have a CT scan without contrast to evaluate for intracranial injuries. This should be performed regardless of the presence or absence of neurologic findings.
   b. Children > 12 months of age should have a CT scan without contrast if there is mental status depression or any other signs of neurological injury. This may also include external signs of head injury, such as facial bruising or scalp hematoma.
   c. If the CT scan without contrast indicates signs of trauma, imaging of the c-spine should be considered and as well as C-spine immobilization.
d. If there is a suspicion of a skull fracture, consider ordering a CT scan with 3D reconstruction, to better clarify fracture versus suture (must be ordered prior to the CT scan being done).

e. If there is clinical concern or disagreement with the outside study, order a formal second opinion read. Having the outside report is helpful but not necessary.

4. Abdominal Imaging

a. Any child who presents with signs/symptoms of abdominal trauma, bruising to the abdomen or torso, or an (ALT/AST that is higher than twice normal) should have a CT of the abdomen/pelvis with IV contrast.

b. Consider abdominal CT if urinalysis has >10 RBCs and/or positive stool guaiac.

5. Skeletal Survey (should be obtained Monday through Friday during normal business hours UNLESS this would delay discharge). **SKELETAL SURVEY ORDER SHOULD BE DEFERRED AND ORDERED BY ADMITTING TEAM IF PT IS EVALUATED DURING EVENING/NIGHT/WEEKEND HOURS.**

a. Children **< 3 years** of age should have a skeletal survey to evaluate for occult fractures.

b. Children **> 3 years** of age can have x-rays focusing on areas of concern rather than the entire skeleton.

c. Consider getting a full skeletal survey in children **> 3 years** of age with developmental delays.

d. For skeletal surveys performed at outside hospitals, consider reviewing it with a Pediatric Radiologist to determine the completeness and quality of the study and the potential need for additional films.

6. Ophthalmology Evaluation

a. Children **< 12 months** of age should have an ophthalmologic evaluation to look for retinal hemorrhages. Retinal photographs should be obtained, when possible.

b. Children **> 12 months** of age should have an ophthalmologic evaluation when eye injuries are suspected, when head injury is suspected, and/or when there is facial bruising.
c. Ophthalmologic examination should be obtained as soon as possible. However, the dilated eye exam should be deferred in children with head injuries pending neurosurgery clearance.

7. Lab Evaluation

a. The following labs should be ordered routinely on all children suspected of NAT:

   - CBC with diff and platelets
   - Lipase
   - CMP
   - PT/PTT/INR
   - Urinalysis with microscopic
   - Stool for occult blood

b. Consider a UDS/toxicology evaluation if there is clinical suspicion of exposure to substances or in children < 2 years of age with altered mental status.

c. Consider Vitamin D 25 Hydroxy, Calcium, Phosphorus and PTH if clinically indicated.

8. Medical Photography

a. Order Medical Photography as soon as possible to document any skin findings at the time of presentation, since they can change rapidly. Medical Photography is available Monday through Friday 9-5.

b. When there are skin findings and Medical Photography is not available, the social workers have access to a camera that can document injuries.

c. When Medical Photography is unavailable the MD/NP/PA will photograph the patient with the camera provided by social work. See policy C-06

d. A healthcare provider must be present while the photographs are taken in order to direct the photographer’s attention to areas of concern.

9. Severe Abuse

a. Victims of severe abuse should have a toxicology evaluation.

b. Victims of severe abuse should have a SANE evaluation if clinical concerns regarding sexual abuse or other need for forensic evidence collection.
10. Siblings
   
a. All siblings or other at risk children in the home < 3 yrs of age, should be evaluated in the ED immediately for a medical screening exam. Pediatric trauma should be consulted. Outpatient follow up and necessary studies will be coordinated by their service. All other siblings or at risk children should be evaluated by their PCP within 24 hours, unless there is evidence of abuse. In this case, these children should also be evaluated immediately in the ED.

b. Upon identification of other possible at risk individuals in the home of a NAT patient, the service managing the patient at the time of discovery should consult Social Work and request Child Protective Services be made aware of those individuals and document accordingly.

11. Admission
   
a. Admit all patients that have a clinical indication. Patients with identified traumatic injuries or who are undergoing an NAT work up will be admitted to an appropriate surgical service. If Pediatric Surgery is not the primary team, they should be consulted to ensure the NAT work-up is completed and appropriate follow-up is in place.

b. Patients undergoing an NAT work-up meet criteria for inpatient status.

c. Admit patients when there is a concern about the safety of the patient, especially if there is a disagreement between the provider and CPS.

12. Discharge
   
a. All children evaluated in the ED where there is concern for possible NAT but who do not meet criteria for inpatient admission should receive a social work consult. Follow up with the CARE clinic should be considered. Assuming the pediatric surgery team has been consulted, any follow up skeletal surveys, repeat x-rays or other imaging that is a future order should be ordered by the Pediatric Surgery team. In addition to this, any impact statement should be performed by the Pediatric Surgery team.
ADDENDUM A

Rating Scale for Abuse Likelihood

1. **Definitely not inflicted injury** (significant, independently verifiable mechanism such as MVC, disinterested witness such as police, ambulance, video documentation, mimic – i.e. Mongolian spot)

2. **Not concerning for inflicted injury** (mechanism explains all injuries, consistent history)

3. **Mildly concerning for inflicted injury** (somewhat concerning injuries with no offered history - i.e. unexplained humerus fracture in a 10-month-old or otherwise unconcerning injury with past suspicious injury and same caregiver)

4. **Intermediately concerning for inflicted injury** (insufficient information to offer an opinion, sequence of events clear but uncertain whether they constitute abuse, necessary lab tests/consultations pending, concerning injury in the setting of bone fragility/bleeding diathesis)

5. **Very concerning for inflicted injury** (given history unlikely to produce documented injuries or concerning injury with no history of trauma – i.e. 4 month old with femur fracture)

6. **Representative of substantial evidence of inflicted injury** (severe injury with no offered history in a child incapable of inflicting the injury on himself or herself, history inconsistent with identified injuries, serious injury with changing history or history inconsistent between caregivers, inappropriate delay in seeking care, multiple severe injuries of different ages without plausible explanation)

7. **Definite inflicted injury** (pattern bruises/burns, unexplained posterior rib fractures, characteristic retinal hemorrhages, reliable eye witness, suspicious injury and concurrently abused sibling, obvious injury with significant, unexplained delay in seeking care – i.e. serious burn, unresponsive child, apparent prolonged seizures)
NAT Smart Phrases Available in EPIC

1. **Bruising**

   .**NORMALBRUISING**: Normal toddler bruising occurs in exploratory surfaces and over bony prominences such as the shins, lower arms, under the chin, the forehead, hips, elbows and ankles. Bruising to the upper arms, torso, cheek, ears, neck, genitalia and buttocks are more likely to be the result of abuse. Bruising to the helix (upper part of the ear) is usually caused by pulling or pinching the top of the ear. Any bruising in a non-ambulatory child with a lack of history of trauma and without evidence of a bleeding disorder is concerning for non-accidental trauma.

2. **Head Injuries**

   .**SHORTFALL**: Falls are the most common cause of injury bringing children to the emergency department and requiring hospital admission. Accidental household falls from furniture most commonly result in minor trauma such as concussion or skull fracture. Serious head injuries purported to be accidental, unless related to a motor vehicle accident or a fall from a significant height, are very likely to be the result of abuse, particularly if the injuries are ascribed to falls from short heights that occur at home, unwitnessed by objective observers (i.e. fall from bed, couch or chair).

   .**SUBDURALHEMATOMA**: A subdural hemorrhage is a collection of blood between the brain and the dura, the brain’s tough outer covering. They are most often caused by moderate to high energy forces to the head and result when bridging veins are stretched and tear during rapid acceleration-deceleration forces. This can occur in a high speed car accident, fall from extreme height or violent shaking. Generally, acute subdural hematomas are less than 72 hours old. The subacute phase begins 3-7 days after initial injury, and chronic subdural hematomas develop over the course of weeks. These time lines offer a general guideline and are not exact. Acute subdural hematomas most often occur shortly after moderate to severe head injury. Symptoms in infants can include loss of consciousness, seizures, lethargy, irritability, poor feeding, vomiting, bulging fontanelle, and pallor. Symptoms usually appear immediately but in some cases, there may be a lucid interval of a few hours after the injury where the child appears relatively well and normal but subsequently deteriorates as the hematoma forms depending on the location, severity and rapidity with which the hematoma develops. Therefore, it is not possible to provide a precise timeline. The finding of subdural hematomas and retinal hemorrhages in infants are significantly more common in non-accidental trauma than in
accidental injury. Retinal hemorrhages are found in non-inflicted head trauma less than 3% of the time.

**BESS:** Benign familial hydrocephalus, also described as benign external hydrocephalus, idiopathic external hydrocephalus, benign extraaxial collections of infancy, or benign subdural effusions of infancy has been raised as a possible cause of spontaneous subdural hematoma. Children with this condition have benign enlargement of the subarachnoid spaces (BESS) on radiologic imaging. Although there remains controversy regarding the possible mechanism, it continues to be proposed in the literature that the presence of BESS is a risk factor for development of SDH from minor unrecognized trauma. There are case reports of patients with BESS who have been incidentally found to have SDH. To my knowledge, none of these children had additional findings of retinal hemorrhages.

3. **Fractures**

**.BIRTHRELATEADFRACTURES:** Rib fractures due to birth trauma can occur, typically in large newborns with a difficult vaginal birth. Healing rib fractures in children older than 3 months or acute fractures in infants older than 1 week are likely the result of non-accidental trauma. Clavicular fractures are the most common birth-related skeletal injury, and a healing fracture in the first 7-10 days of life must be regarded as accidental.

**.CLAVICLE:** Any acute clavicular fracture identified after 10 days of life without evidence of healing is suggestive of abuse. Accidental fractures in the medial or lateral end of the clavicle are uncommon in children less than 3 years of age. These fractures are likely the result of shaking.

**.FEMURFRACTURES:** Spiral femur fractures occur when a rotational force is applied to the leg during twisting or shaking, torsion when the leg is used as a handle for shaking, or from a direct blow. These fractures typically result from high-energy trauma, such as that caused by a fall from a height or a motor vehicle accident. The presence of a spiral femur fracture in the absence of a history of high energy trauma is very concerning for inflicted injury.

**.HUMERUSFRACTURES:** Most non-inflicted humeral fractures are supracondylar in location (near the elbow) and are more common in older children. Abuse related fractures can occur when the arm is used as a handle to the assailant as the infant is pulled, swung or shaken.

**.METAPHYSEALFRACTURES:** Metaphyseal fractures, otherwise known as corner fractures, bucket handle fractures or classic metaphyseal lesions, require biomechanical forces that are not produced by the usual accidental trauma of infancy. These fractures result from shearing forces due to rapid acceleration and deceleration as seen with shaking or rotational forces generated from violent traction or twisting of the extremity and are highly specific for non-accidental injury.
.RIBFRACTURES: Rib fractures in infancy are the result of child abuse more than 80% of the time. Most exceptions to this rule result from high energy trauma. Mechanisms can include squeezing, rotation of the ribs posteriorly with squeezing action, crush injury, or direct trauma. The presence of rib fractures in the absence of a history of high energy trauma is highly suggestive of non-accidental trauma.

.SKULLFRACTURE: The presence of a skull fracture indicates direct impact either from a blow to the head or the rapidly moving head brought up against a static object. Most accidental skull fractures are simple, non-displaced linear fractures occurring over the parietal/occipital region resulting from an accidental fall, are not usually associated with significant clinical problems and do not require treatment.

.TODDLERFRACTURE: Non-displaced spiral fractures of the tibia are a relatively common accidental injury seen in children who are able to stand, cruise or walk (typically 9 months old through age 3). This type of fracture is also known as a toddler fracture or a "Childhood Accidental Spiral Tibial (CAST) fracture. This occurs during routine play activities and may result from running and slipping, jumping and falling, and even sliding with a difficult landing. There may be a delay in seeking medical care because the injury does not initially appear significant. Fractures of this type typically involve the distal half to distal third of the tibia. Fractures of the more proximal tibia may be suspicious for non-accidental trauma.

Fracture Types
.OBLIQUE: Oblique fractures are similar to spiral fractures. They typically result from a bending force with superimposed axial compression, causing the bone to break at an angle. They can result from indirect twisting forces and can be seen in both accidental and non-accidental injury.

.SPIRALFRACTURE: Spiral fractures result from indirect twisting or torsion forces to the bone. They can be associated with abusive injuries primarily in infants and young toddlers. They can also be seen in accidental injury in ambulatory children with a history of a twisting injury. They can also be seen in ambulatory toddlers without a history of trauma (childhood accidental spiral tibia fractures).

_TRANSVERSE: Transverse fractures result from a direct force to the bone and can be associated with both accidental and non-accidental injury.

4. Eye Injuries

.RETINALHEME: Retinal hemorrhages (bleeding within the light sensitive tissue that lines the inside of the back of the eye ball) can occur when there is an elevation of intracranial pressure (the pressure inside the skull and brain tissues), intracranial
hemorrhage (bleeding that occurs inside the skull), hypoxia (deficiency in the amount of oxygen reaching the tissues), anemia (deficiency of red blood cells or hemoglobin) and increased intrathoracic pressure (increased pressure within the pleural cavity). Significant hemorrhagic retinopathy is most often seen in repetitive acceleration-deceleration forces that accompany high energy trauma such as a car accident or abusive head trauma which cause unique shearing forces inside the eye and orbit that result in significant retinal hemorrhage. The bleeding can be in one eye or both eyes and can be asymmetric. A few retinal hemorrhages confined to the posterior pole may be very non-specific and could result from numerous other causes, but massive retinal hemorrhage throughout the entire retina is rarely reported in any other condition than abusive head trauma. Excessive coughing and/or vomiting are unlikely to produce significant retinal hemorrhages. The finding of subdural hematomas and retinal hemorrhages in infants are significantly more common in non-accidental trauma than in accidental injury. Retinal hemorrhages are found in non-inflicted head trauma less than 3% of the time.

.RETINOSCHISIS: The presence of retinoschisis (splitting of the retinal layers) is highly specific for abusive head trauma and results from repeated acceleration-deceleration forces (Levin, 2016). In children less than 3 years of age, the vitreous (a clear, jelly-like substance that fills the middle of the eye) is quite firmly adherent to the macula (an oval, yellow-pigmented area on the central retina) and retinal blood vessels, much more so than in the adult. As a result, the repetitive acceleration-deceleration forces applied indirectly to the vitreous exert shearing tractional forces on the retina causing it to split its layers, forming a cystic cavity that fills with blood. A single rapid acceleration-deceleration force such as a fall would not cause retinal hemorrhages or retinoschisis unless the force rose to the level of a fatal impact or crush (i.e. a motor-vehicle crash or fall from greater than 10 meters). There is overwhelming evidence in the literature that supports the conclusion that severe hemorrhagic retinopathy in an otherwise previously well child without obvious history to the contrary (fatal head crush) suggests that the child has been subjected to abusive repetitive acceleration-deceleration trauma.