

# The Use of Medical Imaging in Diagnosing Child Abuse

## Introduction

Child abuse involves acts of violence that can leave emotional or physical consequences for a child. There has been an increase in child abuse and neglect in the United States. (Johnson, 2017).

Medical imaging is an effective way to diagnose child abuse in addition to a complete medical history and exam. According to Johnson (2017), a radiographer who published a research article through ASRT, stated “diagnostic images reveal clues that enable radiologists to determine the severity and timing of injuries and can demonstrate additional, occult trauma” (p. 48).

## Imaging Modalities

The three most common modalities used in the aid of diagnosing child abuse are conventional radiography, computed tomography (CT), and magnetic resonance imaging (MRI). Conventional radiography is the most common modality used in the aid of diagnosing child abuse (Johnson, 2017)

These modalities produce images in different ways that are used with specific exam to show specific pathologies. Conventional radiography uses ionizing radiation to produce a two dimensional image. CT uses a complex system and ionizing radiation to capture axial images and can reconstruct them three dimensionally. MRI uses non ionizing electromagnetic radiation and with manipulation of atoms to create diagnostic images (Carlton & Adler, 2013).

Imaging Modality	Exams
Conventional Radiography	<ul style="list-style-type: none"> <li>•Skeletal surveys are mandatory for any child under the age of two (Johnson, 2017).</li> <li>•Specific bone exams are used for patients over the age of two who can communicate generalized pain (Johnson, 2017).</li> </ul>
Computed Tomography	<ul style="list-style-type: none"> <li>•Patients who come in and need immediate acute care due to a thoracic or abdominal trauma will usually receive a CT exam of the abdomen and thoracic cavity (Johnson, 2017).</li> <li>•With any suspected abuse patient, even if a head trauma is not visually seen, a head CT is typically ordered (Johnson, 2017).</li> <li>•Modality of choice for neurological images (Flom et al, 2016).</li> </ul>
Magnetic Resonance Imaging	<ul style="list-style-type: none"> <li>•MRI in child abuse cases have a wide range of abilities for creating images (Johnson, 2017)</li> <li>•According to Johnson (2017) “MR imaging primarily is used to diagnose subacute and chronic brain injury in the nonemergent setting” (p. 61).</li> </ul>



Image 1  
Complex skull fractures of abused three month old (Johnson, 2017).

Reference

Carlton, R. R., & Adler, A. M. (2013). *Principles of radiographic imaging: An art and a science*. Clifton Park, NY: Delmar/Cengage Learning.

Flom, L., Fromkin, J., Panigrahy, A., Tyler-Kabara, E., Berger, R., & Berger, R. P. (2016). Development of a screening MRI for infants at risk for abusive head trauma. *Pediatric Radiology*, 46(4), 519-526.

Greeley, C. S. (2015). Abusive head trauma: A review of the evidence base. *American Journal of Roentgenology*, 204(5), 967-973. doi:10.2214/AJR.14.14191

Johnson, M. M. (2017). Imaging and diagnosis of physical child abuse. *Radiologic Technology*, 89(1), 45-67.

Zuccoli, G., Panigrahy, A., Haldipur, A., Willaman, D., Squires, J., Wolford, J... Berger, R. (2013). Susceptibility weighted imaging depicts retinal hemorrhages in abusive head trauma. *Neuroradiology*, 55(7), 889-893.

## Diagnostic Findings

Abusive Head Trauma (AHT)	<ul style="list-style-type: none"> <li>• Most common type of child abuse.</li> <li>• According to the U.S. Centers for Disease Control and Prevention, AHT is “an injury to the skull or intracranial contents of an infant or child younger than five years caused by inflicted blunt impact, violent shaking, or both” (Greeley, 2015, p. 967)</li> <li>• Main indication is subdural hematoma.</li> <li>• Skeletal fractures are also indicative to AHT, especially rib fractures which can be caused by forcibly shaking baby (Greeley, 2015).</li> <li>• Retinal hemorrhages are caused by AHT which can be seen with MRI using a high resolution orbits SWI protocol (Zuccoli et al., 2013).</li> </ul>
Skeletal Fractures	<ul style="list-style-type: none"> <li>• Second most common form of child abuse.</li> <li>• Fractures are classified on a scale of high, moderate, and low specificity for abuse.</li> <li>• High specificity for abuse fractures are fractures that are highly likely to be caused by abuse which include rib fractures, classical metaphyseal lesions, scapula fractures, sternum fractures and spinous process fractures (Johnson, 2017).</li> <li>• Moderate specificity fractures are fractures that have a moderate suspected cause from abuse and depends on the child's mobility. These include long bone diaphyseal fractures, epiphyseal separation fractures, vertebral body fractures and subluxation, complex skull fractures, and digital fractures (Johnson, 2017).</li> <li>• Low specificity for abuse are fractures that are most common. These fractures include clavicle fractures, linear skull fractures, and long bone fractures (Johnson, 2017).</li> </ul>

## Conclusion

The availability and use of multiple imaging modalities include the three most common: conventional radiography, CT, and MRI. The specific exams used to create diagnostic images and the results from those exams can help aid in the diagnosis of child abuse. It is the goal of any healthcare professional to preserve life and with special care, detailed medical history, physical examinations, clinical investigations and diagnostic images, child abuse can be proven. With diagnosing child abuse we can help save children from potentially life-threatening situations. Unfortunately, child abuse will always be present in society. Increasing technology and education for imaging modalities will continue to aid in the diagnosing of child abuse.