ECRONICON OPEN ACCESS

EC PAEDIATRICS
Case Study

Radiological Abuse in Infantile Non-Accidental Trauma

John E Handelsman*

Hassenfeld Children's Hospital at NYU Langone, New York, USA

***Corresponding Author:** John E Handelsman, Pediatric Orthopedic Surgery, 28 Blossom Terrace, Lachmont, New York, 10538, USA.

Received: February 28, 2022; **Published:** March 31, 2022

Abstract

Infantile child abuse warrants a thorough investigation. Radiological examination must however, relate to clinical findings, rather than to a rigid preconceived protocol. The clinical records and X-rays of five infants aged two to seven months were reviewed. All had a single limb injury. None had bruising or other evidence of previous or concurrent abuse. All were neurologically intact. The general examination was normal. The family environment was appropriate in every instance.

The radiological examination included the necessary skeletal survey of the limbs, ribs and spine. In addition, however, each child was subjected to a CT brain scan (equivalent to 350 chest X-rays), as well as multiple CT scans of the thorax, abdomen and pelvis. One infant was re-X-rayed for potential "healing fractures". The CT scans of the brain were also repeated. His twin sister, without prior clinical examination, was subjected to a similar radiological study.

All fractures healed rapidly and completely. A simple cause for the injury was established in every case. Family court judges found no abuse in any instance.

The CT scans exposed these infants to very high doses of radiation. All were performed by protocol, without any clinical indication. This is potentially harmful. There is strong evidence of the subsequent development of acute leukemia and brain tumors. Potential damage to the developing brain, causing learning problems, have also been reported.

Physicians in hospitals that evaluate infants who may have been abused, must be dissuaded from following a rigid departmental or institution-directed radiological protocol that is potentially harmful. Selected radiology should augment a thorough clinical examination.

Keywords: *Radiological Abuse; Infantile; Trauma*

Introduction

Five infants aged 2 to 7 months, who had sustained a limb injury, were brought by their concerned parents to various children's hospitals, all associated with a medical school. A preliminary diagnosis of child abuse was made in each case. Four of the children and their

siblings were placed in foster care. Legal action was brought against the babysitter of the fifth infant. At the request of the lawyers defending the parents and the babysitter, the medical records and X-rays of these five infants were reviewed.

Findings

Ashley-age 2 months. Mother noted irritability for several days and apparent discomfort with diaper changes. A stable spiral fracture of the left femoral shaft was found on X-ray (Figure 1). It was subsequently discovered that the left leg was held when the baby fell off a changing table at daycare.

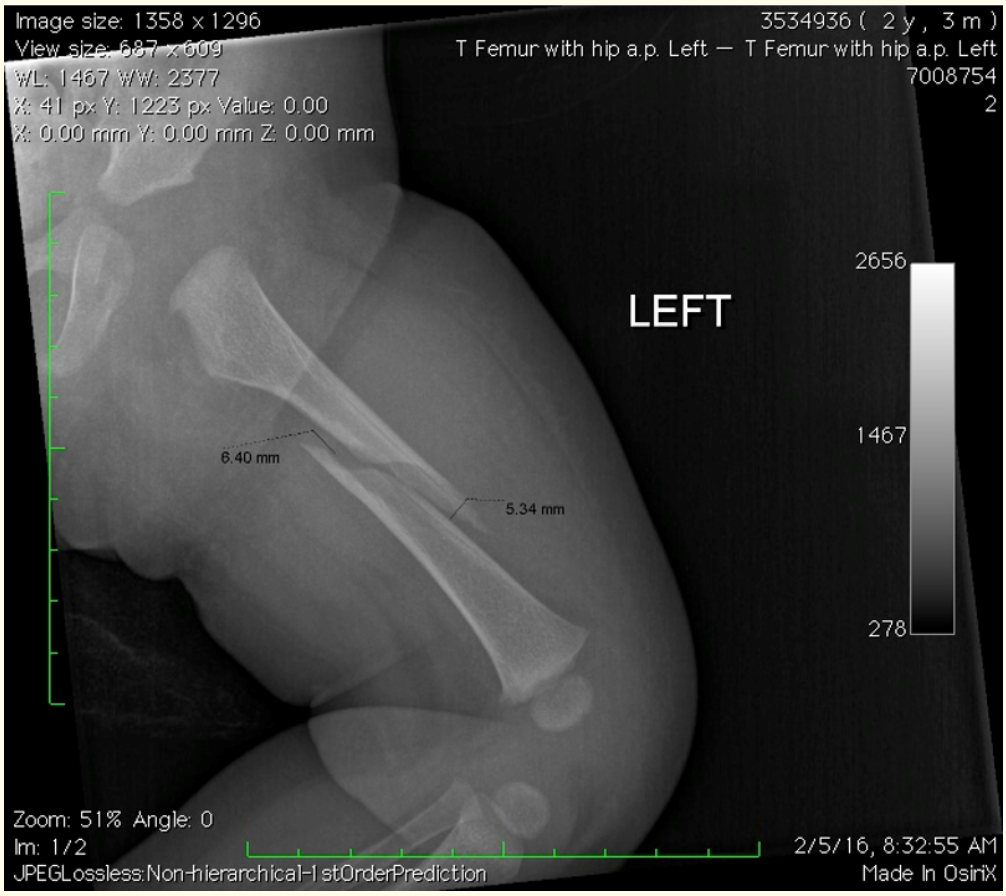

Figure 1

Wyatt-age 4 months. This healthy boy sustained a transverse fracture of the right humerus (Figure 2). His parents frequently swaddled his arms to his chest to keep him calm. Father lifted him under the arms whilst so swaddled. He has a normal twin sister.

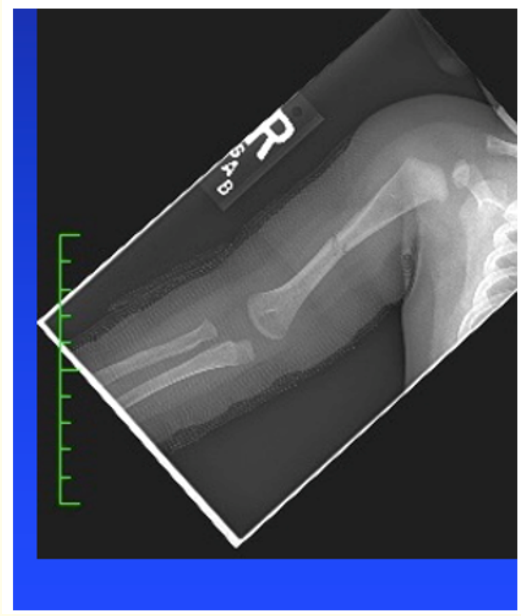

Figure 2

Clara-age 10 months. An active girl who at daycare fell from an infant swing onto an extended left leg. She sustained minor buckle fractures of the distal left femur and of the proximal left first metatarsal (Figures 3a and 3b).

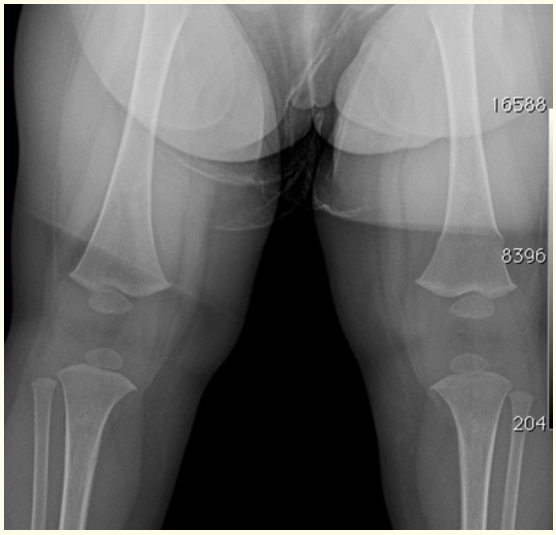

Figure 3a

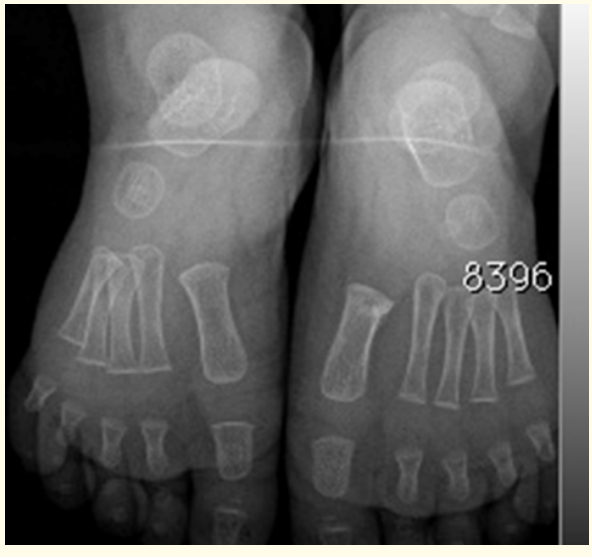

Figure 3b

Ethan-age 3 months. This otherwise normal baby boy suddenly stopped moving his right elbow and appeared to be uncomfortable. The concerned mother brought him to a children's hospital emergency room. An X-ray of the elbow revealed mild periosteal elevation along the distal humerus shaft, so a diagnosis of a fracture was made, although this was not otherwise apparent. By the next morning, he was moving the elbow normally. It was subsequently established that his older sibling had vigorously pulled his arm, causing a "pulled elbow." This minor displacement of the annular ligament around the head of the radius typically resolves rapidly. The periosteal elevation was found in other long bones, and a diagnosis of recovering rickets was established (Figures 4a and 4b).

Figure 4a

Figure 4b

Katiane-age 8 months. This generally healthy girl was irritable when father brought her home from day care. Her pediatrician diagnosed an upper respiratory infection. There was no record of a lower limb examination. An X-ray taken the next day at a children's hospital emergency room revealed a fracture of the shaft of the left femur. Further investigation established that she had accidentally fallen off the changing table earlier at day care.

Figure 5

Chart Review Details

The medical records revealed that each infant was examined by emergency room doctors, orthopaedists and the Child Protection Team pediatrician. The X-rays were reviewed by the Department of Radiology and their report was repeated by the examining pediatricians.

Apart from the injured limb, the clinical examination of each child was completely normal. Specifically, there was no evidence of bruising, swelling or skin discoloration. Each infant was completely appropriate neurologically. None had conjunctival hemorrhages, a sign of a shaken baby. The uninjured limbs were completely normal with no evidence of past injury or fracture.

The social worker's review of the family backgrounds established that all were appropriate. Four of the five infants had a healthy unharmed sibling.

Radiological Assessment

Each infant underwent a full skeletal survey. This included X-rays of all limbs, the spine, and ribs. In addition, however, full CT scans of the brain, chest, abdomen, and pelvis were also obtained. Wyatt, two weeks after he was first seen, was subjected to a repeat skeletal survey to "evaluate for possible healing fractures." The records established that the brain CT scans were also repeated. Furthermore, his twin sister, without a previous clinical examination, was subjected to a full skeletal survey and CT scans of the brain.

A review of the actual X-rays as well as the reports of the CT scans established that, apart from the injured limbs, all radiographs were normal. The only minor deviation was in the limb films of Ethan, where mild periosteal elevation was visible in other long bones, suggestive of healing rickets.

The reports of the CT scans of brain, thorax, abdomen and pelvis were all completely normal in every infant.

Outcome

A clear cause for the fractures and elbow injury was established in every instance. These were accepted by the family court judges who found no abuse in any instance. The children who had been placed in foster care were returned to their parents, and the charges against the babysitter were dropped.

Discussion

It is the duty of all physicians who evaluate infants with fractures to be aware of potential child abuse. When there is no clear evidence of the cause, it is appropriate to consult with the Child Protection Team. Assessment must include a thorough physical examination as well as an evaluation of the home background and the health of any siblings. Radiologically, a skeletal survey is essential. CT scans, however, which subject infants to huge amounts of ionizing radiation, should only be obtained when there is strong clinical evidence of the need. Limited CT cuts of the brain may be appropriate, for example, when examination reveals neurological involvement.

The Unit of Effective Dose (mSv) for infants under one year of age, when submitted to CT scans, is very high. Scans of the head are equivalent to 350 chest X-rays. In the pelvic area, the equivalence is 335 chest X-rays, and those in the thorax and abdomen are also quite substantial (Figure 6).

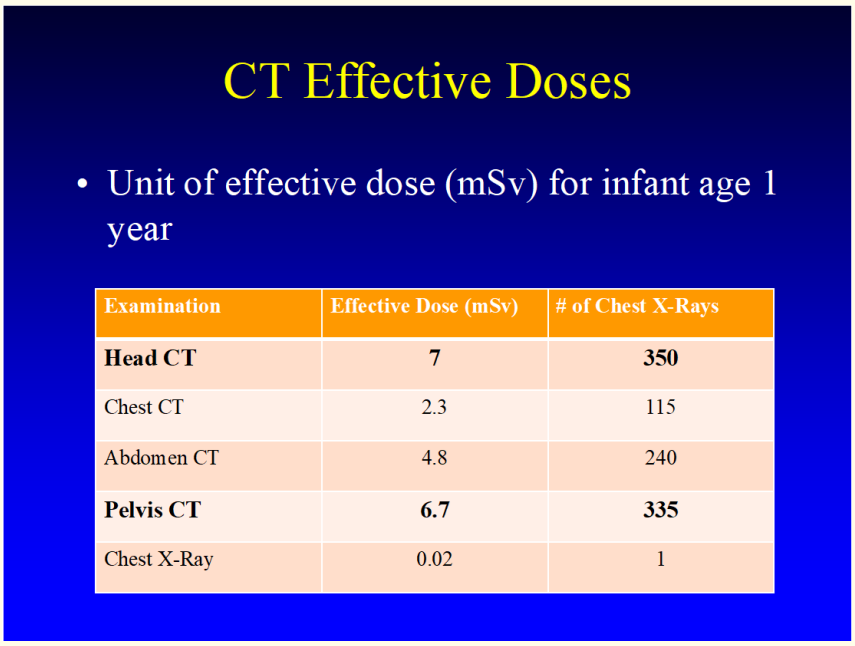

Figure 6

Infant tissues, especially the brain, are particularly susceptible to the effects of radiation. There is substantial evidence of subsequent risk of brain cancer and leukemia, cited by Pearce., *et al*. [1]. Miglioretti., *et al*. reported an increased risk for solid organ cancers following CT scans of the chest, abdomen and pelvis [2]. Following brain scans, learning disabilities have been reported by Fogarty and Accardo [3].

CT scans are powerful investigative tools. Their use, however, produces significant and potentially dangerous levels of ionizing radiation. This is particularly true in infants. Radiological assessment is an ancillary to a full clinical examination. There must be a clear clinical indication before CT scans are ordered. There is no place for CT scans to be part of a "routine" investigation in potential child abuse.

Conclusion

Pediatricians, clinical departments and children's hospitals have a duty to recognize non-accidental trauma. A protocol must include a thorough clinical examination and family background investigation. A full skeletal survey is required radiologically.

The inclusion of routine harmful CT scans without a clear clinical indication, must be eliminated.

Acknowledgements

Jeffrey Thompson, DO, Orthopedic surgery, Nassau University Medical Center, East Meadow, New York.

Thomas Cummings, DABR, Radiation Safety Office, NYU Langone Medical Center, New York.

Bibliography

1. Pearce MS., *et al*. "Radiation exposure from CT scans in childhood and subsequent risk of leukemia and brain tumors: A retrospective cohort study". *Lancet* 380.9840 (2012): 499-505.

2. Miglioretti DL., *et al*. "Pediatric Computed Tomography and Associated Radiation Exposure and Estimated Cancer Risk". *JAMA Pediatrics* 167.8 (2013): 700-707.

3. Fogarty K and Accardo P. "Acute leukemia. Learning disabilities following CNS irradiation". *Clinical Pediatrics* 27.11 (1988): 524-528.

Volume 11 Issue 4 April 2022