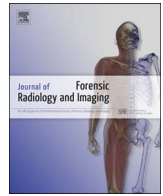




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## Case report

## Forensic Radiology to the Rescue: Prenatal imaging used to solve a case of a newborn with suspected non-accidental trauma

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## ABSTRACT

The allegation of child abuse, or non-accidental trauma, is very serious and can have a devastating impact on children and their families. However, the lack of recognition of injuries resulting from abusive incidents can be equally detrimental. When a child presents to the emergency facility with a suspicious injury it is of the utmost importance that a well-documented medical history be obtained.

We present a case of a 3-day old infant sent to the pediatric ER after the pediatrician noted bruising over the right shoulder and clavicle. A subsequent skeletal survey performed demonstrated a mildly depressed skull fracture and an overriding displaced right clavicular fracture raising a concern of non-accidental trauma (NAT). Upon further review of the patient's history, it was noted that the mother was involved in a high-speed motor vehicle collision on the day of delivery. Review of the mother's body trauma computed tomography (CT) scan revealed that the injuries were, in fact, sustained in utero and obviating the need for further NAT work up and investigation. This case demonstrates forensic use of radiologic images to establish a diagnosis of an accidental trauma.

## 1. Introduction

In 2015, nearly 700,000 children in the United States were victims of abuse and neglect [1]. The youngest of children are the most vulnerable to maltreatment. In fact, 24 of 1000 children under the age of one are victimized [2]. Bruising can often be the only indicator for more serious injury and warrants further investigation by the clinician [3]. Early recognition of suspicious injuries provides an opportunity for the clinician to protect a vulnerable child.

The radiographic skeletal survey is the standard for evaluating possible victims of child abuse. Skeletal surveys influence the diagnosis of abuse in more than half of positive cases [4]. Fractures are the second most common injury caused by physical abuse of the child [5]. Of all fractures caused by child abuse 80% are inflicted upon children younger than 18 months [6]. Certain fractures are known to have a high-specificity for child abuse. Posterior rib fractures and the classic metaphyseal lesions of the long bone have a high specificity for non-accidental trauma [7]. On the other hand fractures, such as clavicular fractures or linear skull fractures, although have a low specificity for child abuse raise a high level of suspicion of abuse in a situation without pertinent history.

Here we present a case of suspected child abuse which after careful history-taking and review of mother's prior imaging resulted in the

diagnosis of accidental trauma.

## 2. Case report

A 3-day old term female neonate presented to the ER after being sent from the pediatrician's office for bruising over the right shoulder. Initial chest radiograph revealed a minimally displaced mid shaft right clavicular fracture (Fig. 1). Given that there was no documented clavicular fracture in the birth record, concern for domestic abuse in the home and an underage mother, a skeletal survey was ordered. At the time of obtaining the skeletal survey, no significant antenatal history was provided. Skeletal survey films revealed a mildly depressed parietal fracture (Fig. 2). No additional fractures were identified. These findings further supported the suspicion of NAT.

The main savior of the case was a detailed history retrieval by the Radiology team. Upon detailed review of hospital information system, it was noted that the mother had a trauma computed tomography (CT) 3 days prior. The mother's history revealed that she had been a restrained front seat passenger in a high-speed motor vehicle collision with airbag deployment that had resulted in premature rupture of membranes and early labor at 38 weeks gestation. Secondary review of the mother's trauma CT revealed a depressed right parietal skull fracture (Figs. 3–6) and right clavicular fracture (Fig. 7) in the fetus that

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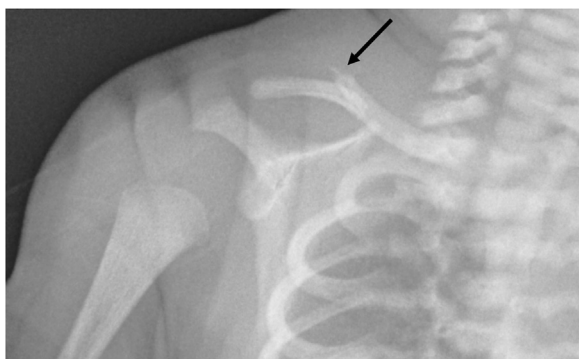


Fig. 1. Frontal X-ray view of the right clavicle demonstrating a displaced mid-clavicular fracture (black arrow) with 5 mm of bony overlap.

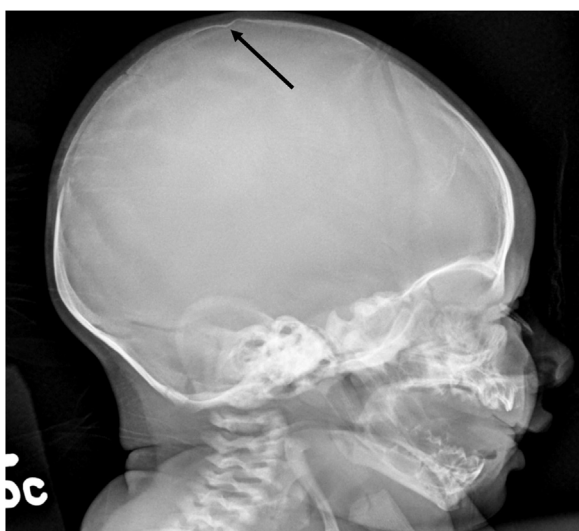


Fig. 2. Lateral skull X-ray depicting a mildly depressed right parietal bone fracture (black arrow).

were not initially reported. Given that these findings were in fact seen in the mother's prenatal trauma CT – it was deemed that these fractures were accidental and likely sustained at the time of motor vehicle collision.

The patient was seen by a pediatric orthopedist who instructed the mother to gently swathe the infant and start gentle range of motion exercises in 10–14 days with outpatient follow up. Pediatric neurosurgery was also consulted and judged the patient fit to discharge from a neurosurgical perspective. At the time of orthopedic follow up, 2 weeks later, no further intervention was deemed necessary. Further, the infant was deemed to be safe with the parents.

### 3. Discussion

A detailed history and review of the medical records can help the physician determine whether a fracture was inflicted by abuse or a result of an unintentional injury. It is important to consider the child's age and developmental stage, the type and location of the fracture and an understanding of the mechanism that may cause the fracture.

In children of less than one year, linear skull fractures of the parietal bone are the most common skull fracture [8] and the majority of these fractures in isolation are accidental [9]. Fractures of the clavicle are the most prevalent post-partum fractures [10]. A direct blow to the clavicle will result in a fracture of the mid-shaft, while a traction is more likely to cause a lateral fracture [11].

Motor vehicle collisions are responsible for over half of the causes of trauma in pregnant patients [12]. Pregnant patients pose a diagnostic

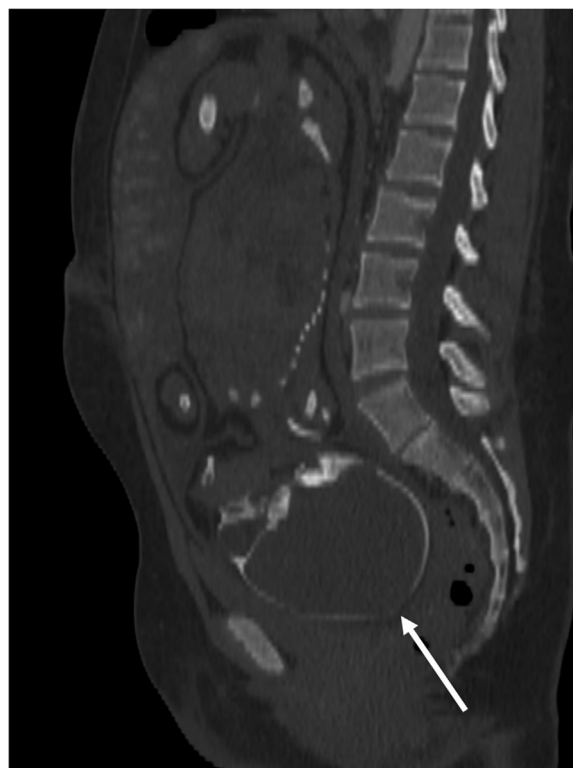


Fig. 3. Sagittal CT image in bone algorithm depicting a depressed right parietal fracture in the fetus (white arrows).

challenge for the radiologist as there are two patients to be evaluated. During the third trimester the uterus is above the level of the pelvic rim, the fetal head is engaged in the bony pelvis putting the fetus at the greatest risk of injury [13]. Additionally there is less fluid present to cushion the fetus from injury [14]. For those reasons, the most commonly reported direct injury to the fetus is to the skull and brain [15]. It is said that a direct blow to the maternal abdomen causing the mother no harm can be catastrophic to the fetus secondary to compression against the maternal sacral promontory [13]. Furthermore, given that the mechanism of injury can be compared to shock waves transmitted through the amniotic fluid injury may occur over a greater surface area as opposed to a localized injury [16]. Hartle and Ko describe a case of a child with a linear skull fracture after motor vehicle collision in which the mother was without any significant injuries [17]. Multiple depressed skull fractures have also been seen in cases of in utero trauma.

### 4. Conclusion

It is of the utmost importance to obtain a complete prenatal maternal history when considering cases of child abuse in the neonate. The traumatic forces sustained in motor vehicle collisions may be responsible for certain suspicious appearing skeletal fractures. Maternal pre-natal imaging should be used to solve diagnostic dilemmas in the peri-natal period.

### Declaration of interest

None.

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