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Not everything is child abuse

Abstract When an infant presents in the emergency room with a single bone fracture, almost immediately the parents or caretakers become suspected of child abuse. This can lead to awkward problems of false accusation. The trouble stems from the fact that we have become so sensitized to child abuse that often we forget to consider other possible explanations for a fracture. This paper deals with this difficulty and discusses entities such as birth trauma, fractures in metabolically weakened bones, fractures through dysplastic bones, the “pulled elbow”, and hematologic disease.

Key words Child abuse – Fractures – Disease mimicking abuse

Introduction Child abuse is a significant problem in pediatric medicine, and over the last two decades great strides have been made in identifying this problem and dealing with it. Radiology plays a major role in the detection of skeletal injury and correlating the findings with the reported mechanism of injury in terms of the plausibility of the latter. However, we all have become so aware of and sensitized to intentional trauma to infants and children that often there is a “knee-jerk reaction” to the finding of a solitary fracture. Unfortunately, every so often this leads to a degree of “jumping the gun” and an overly hasty diagnosis of child abuse. While there is no desire to have any abused children escape proper identification and care, when parents or caretakers are falsely accused of battering a child the emotional consequences can be significant. We, as physicians, are protected by law and it is our duty to report these cases, but we should still be cautious, for not everything we see in the way of what initially looks like child abuse is actually child abuse. In some cases the injury is legitimate but the circumstances leading to the injury may be peculiar. For this reason, one of the most important aspects of investigating child abuse is to obtain a proper and detailed history, detailed particularly in terms of exactly how the trauma occurred. Furthermore, the story should not change. Ideally obtaining such a history would, and should, require that the child protective services personnel visit the home of the patient or place of injury and reconstruct the events leading to the injury. Generally if the history is plausible (even if it is a little “different” or unusual), and the story does not change, one probably is dealing with legitimate, accidental trauma.

Specific injuries

Epiphyseal-metaphyseal corner fractures

Epiphyseal-metaphyseal corner fractures are the hallmark of the battered child syndrome and were amongst the first described [2]. In infants they are virtually pathognomonic, but they also can be seen with birth trauma, especially in infants delivered from the breech position (Fig.1). They also can be seen when an underlying bone is weakened due to some metabolic or hematologic problem. In such cases these fractures can be encountered under very ordinary circumstances and it is important that they not be mistaken for similar injuries seen in child abuse. One of the key findings in the bones of these patients is that they appear osteomalacic or osteoporotic. The bones in most battered infants and children are normally mineralized.

In terms of demineralized bones, a special situation arises in premature infants whose bones are demineralized because they suffer from so-called metabolic bone disease of the premature [3, 4]. In these cases multiple epiphyseal-metaphyseal, metaphyseal corner, long bone, rib, and clavicular fractures may erroneously, but

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strongly, suggest that child abuse is the problem. To complicate matters, many times these infants are encountered when the bony changes are healing (Fig. 2) and thus the classic findings of metabolic bone disease (i.e., osteoporosis, osteomalacia) are less evident. For the most part, the metaphyseal changes in these infants resemble rickets more than any other condition. The past history is very important in these patients, for once one realizes that these patients were chronically hospitalized as premature infants the correct diagnosis is more readily established.

Long bone fractures

Generally speaking, isolated long bone fractures, usually involving the femur and humerus, in children under the age of 2 years are treated with high suspicion [5, 6, 7]. The rule is more rigid with humeral fractures than with femoral fractures because femoral fractures can more often be sustained on a legitimate basis in the 2nd year of life than can humeral fractures. On the other hand, it also should be remembered that any of these patients may have sustained the injuries in a legitimate manner. In all of these cases, as previously noted, a detailed clinical history is very important. What one is looking for is a plausible explanation by the caretaker which does not change. The latter is very important, for in some of these cases circumstances leading to the trauma may at first appear suspicious, but when one examines them more closely it becomes apparent that they could have occurred legitimately.

In terms of femoral and humeral fractures in infants, outwardly angled fractures of the humerus or femur, in my experience, generally are due to nonaccidental trauma. In such cases outward leverage is applied to the involved extremity when the knee or elbow is grasped and the extremity is pulled away (yanked) from the body. Under such circumstances a fulcrum develops in the midshaft of the involved long bone and an outward angulated fracture results (Fig. 3). Basically it is impossible for an infant to sustain such an injury under other circumstances, but if, for example, an infant squirming and falling out of a caretaker’s arms were grabbed by the elbow or femur, to stop the fall, such a fracture could be sustained. Once again, accurate history is very important. In addition, in many of these cases, as with all isolated long bone fractures, the problem may not be true abuse but rather impulsive, inappropriate, and detrimental action on the part of the caretaker. This is where counseling is most important. On the other hand, if a fracture of the long bones is encountered in an infant and no plausible history is obtained, or the history changes, one should become very suspicious (Fig. 4). Usually with legitimate trauma the individual involved knows exactly what happened and can tell you how it happened over and over again without any change in the story.

Long bone fractures in dysplastic or metabolically weakened bones should not either be misinterpreted as the result of child abuse. For example, such fractures can occur with osteopetrosis, osteogenesis imperfecta, metabolic bone disease of the premature, and congenital pseudoarthrosis of the tibia and fibula. There usually is no problem with recognizing osteopetrosis, for the bones are very dense. Congenital pseudoarthrosis of the tibia also has a rather typical appearance, although I have encountered a case where the findings were misinterpreted for those of child abuse (Fig. 5).

With osteogenesis imperfecta, in older infants and children, if fractures occur, they occur in the tarda or milder form of the disease. In these cases the bones tend to be somewhat slender but not particularly demineralized, and fractures are ordinary but occur more often than in normal children. In infants, fractures seen with osteogenesis imperfecta usually are associated with other findings of the disease, such as bending of the bones and wormian bones in the calvarium (Fig. 6).

The problem of distinguishing an abused infant from a patient with osteogenesis imperfecta arises frequently, for almost every attorney dealing with battered children will bring up the possibility of osteogenesis imperfecta. In the end, it is important to appreciate that the diagnosis of osteogenesis imperfecta can be made clinically and with laboratory tests and tissue biopsy [8, 9]. The radiologist is not the one to unequivocally rule out the diagnosis, although his or her opinion can be quite influential. In terms of osteogenesis imperfecta, fractures in infants