

A rare case of symmetric bifemoral fractures in battered child syndrome and overview over the literature

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We report on a 1-year-old girl who was suspected for battered child syndrome. A conventional X-ray showed a symmetric bifemoral fracture close to the distal growth plates and a leftsided parietal fracture. However, bone scintigraphy revealed only a slight symmetric widening of the corresponding growth zones in the axial direction when compared with the proximal tibial growth areas while the parietal fracture was missed. A diagnostic difficulty is stressed, and a criteria for bone scanning in battered child syndrome are reviewed.

Key words: battered child syndrome, femoral fractures; radionuclide imaging

Case history and clinical findings

A one-year-old girl with a history of fever and diarrhea for three days was admitted to the children's hospital. The girl's left leg was in a cast due to a distal femoral fracture. She suffered from pain in her right leg so that she refused to get in a standing position for a week. This drew attention to a suspected fracture of the right femur. Moreover, she had several hematomas of different age all over the body and a blood-crust-ed exanthema at the occiput. A bilateral

periocular hematoma was noticed by her pediatrician three weeks ago which was explained by her mother to be caused by falling twice against a table. She was noticeably frightened about foreign people. Her general, nutritional and care conditions were poor. The examinations were undertaken in order to prove a suspected battered child syndrome.

Laboratory results

C-reactive protein was markedly increased at 2.9 mg/dl (normal: < 0.8 mg/dl). All further standard laboratory findings, i.e. blood cell count of erythrocytes, leucocytes and platelets were in the normal range.

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X-ray

An X-ray of both femurs showed a bilateral transverse fracture at both distal diaphyses in close relation to the corresponding growth plates: on the left side an older fracture with callus formation was evident and at the right side a new fracture without any callus formation was seen (Figure 1). A lateral X-ray of the



Figure 1. Anteroposterior X-ray of the knees showing an older transverse fracture with callus formation in the left distal femoral meta-diaphyseal region, and a fresh fracture without callus formation in the right distal femoral meta-diaphyseal region.

skull showed a large left-sided parietal fracture (Figure 2) without signs of a basocranial fracture. A computer tomography of the skull revealed no signs of cerebral or subdural hematoma. A chest X-ray showed a dislocation in the costo-vertebral junction of the 10th left rib.

Bone scintigraphy

Conventional bone scintigraphy was performed 3 hours post i.v. injection of 200 MBq Tc-99m-HDP in anterior and posterior views using a double head gamma camera equipped with a low energy high resolution collimator. An increased tracer uptake was seen next to the distal femoral growth plates

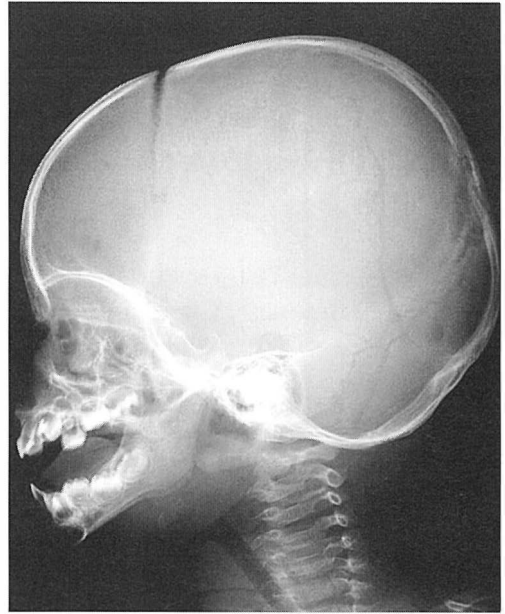


Figure 2. Lateral X-ray of the skull showing a left-sided parietal fracture.

on both sides corresponding to the fracture sites. Moreover, a slight widening of the distal femoral growth plates was observed when compared to the proximal tibial growth plates. Furthermore, a diffusely higher uptake in the diaphysis of the right femur was seen in this patient (Figure 3). Focal tracer uptake was evident at the costo-vertebral junction of the 10th left rib. Marginally increased asymmetric tracer uptake was seen at the left side of the skull, but this was considered as normal since the patient's head was turned slightly to the left. No further spot images were performed.

Therapy

The right leg was stabilized by a cast. Since battered child syndrome was very likely by the results of all examinations the custody for the child was withdrawn from the parents.

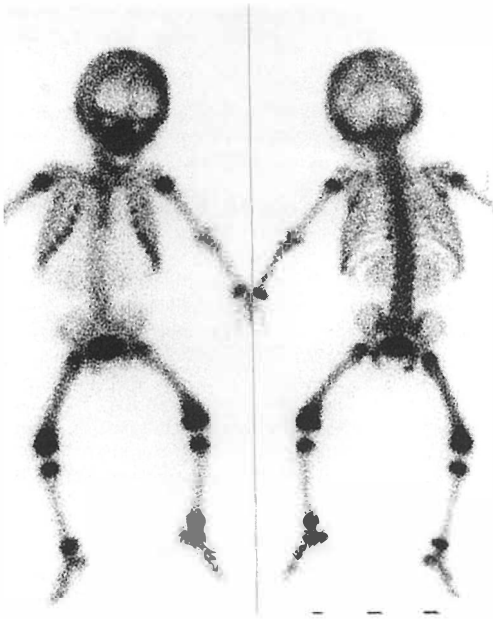


Figure 3. Conventional whole-body bone scintigraphy in anterior and posterior views showing increased tracer uptake of both distal growth plates of the left and right femur and bilateral slightly widened distal femoral growth plates as compared to proximal tibial growth plates. Furthermore, a diffusely higher uptake in the diaphysis of the right femur is seen in this patient. Moreover, focal tracer uptake is evident at the costo-vertebral junction of the left 10th rib. Marginal enlarged asymmetric tracer uptake in the left side of the skull.

Discussion

A child abuse and a battered child syndrome show an increasing incidence with a high estimated number of unreported cases in the last few years.^{1,2} Characteristic clinical findings of a battered child syndrome are hematomas, retinal hemorrhage, skin burns and fractures of different ages situated predominantly in the skull, ribs and metaphyses of the long bones.³⁻¹⁴ For forensic consequences a suspected battered child syndrome has to be proved carefully.¹⁵⁻¹⁹ Thus, several diagnostic methods have been established as screening procedures in order to prove bone involvement, e.g. bone scintigraphy and X-ray studies.^{20,21} However, there is still a high

number of false-negative results both in scintigraphy and conventional radiologic examinations varying from 1-50%.^{2,3,22-25} Therefore, a single diagnostic method is not sufficient to prove all osseous and abdominal lesions. Consequently, a variety of examinations, i.e. bone scintigraphy, X-ray, and computerised tomography may be necessary to sufficiently prove all lesions.^{4,26,27,28}

The detection of metaphyseal fractures located near the growth plate by bone scintigraphy is difficult since there is an increased tracer uptake due to physiological activity in this region. Thus, an important diagnostic criterion in the detection of these fractures is an asymmetric tracer uptake. Nevertheless, a high number of false negative bone scans in fractures located close to the growth plates has been reported by several authors.^{2,29}

In our patient bone scintigraphy yielded slightly enhanced tracer uptake of both distal femoral growth plates indicating increased bone activity in the fracture sites. Moreover, a slight widening of both distal femoral growth plates in axial direction was observed. Thus, the detection of symmetric bifemoral fractures in bone scan was hampered first by the cast on the girl's left leg which made an accurate symmetric positioning impossible, second by the localization of the fractures close to the growth plates which show physiologically increased tracer uptake, and third to a lack of side-related differences due to the bilateral occurrence of the fractures. The only hint pointing out a symmetric bifemoral fracture was the widening of the distal femoral growth plates in axial direction when compared to the proximal tibial growth plates.³⁰ Furthermore, a diffusely higher uptake in the diaphysis of the right femur was seen in this patient which may be one of the typical presentations in a battered child.

As compared to conventional X-ray the parietal fracture of the skull showed only a slightly enhanced tracer uptake. This was considered normal since the patient's head

was turned slightly to the left. A high number of false-negative bone scans in the detection of skull fractures is well-known.^{23,25} Focal tracer accumulation at the costovertebral junction of the 10th left rib was shown by a conventional X-ray to be related to a slight dislocation of the rib.

With respect to our findings we would like to emphasize some points that should be kept in mind in differential diagnosis of a battered child syndrome:

- Bone scintigraphy in these patients is both demanding and not frequently performed. Thus, a special attention should be paid to it.
- An exact symmetric positioning should be ensured in order to allow an accurate side-to-side comparison.
- Images with excellent count statistics should be acquired in order to enable the detection of the minor increased focal tracer uptake. Thus, sometimes the sedation of the patients may be necessary for the scintigraphic imaging to avoid misleading artefacts.
- In addition to a whole-body scintigraphy spot images should be obtained, e.g. lower extremities, vertebral spine, skull from lateral views or from a parietal top view.
- Even under most accurate conditions there is a decent number of false-negative results in either bone scintigraphy or conventional X-ray.
- Therefore, the final evaluation of bone lesions should include all lesions found either by the bone scintigraphy or by the conventional X-ray.

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