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Continuing medical education

A case from Stanford University

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A six-year-old girl with low-grade fevers and hip pain was referred to Nuclear Medicine for a three-phase bone scan, to rule out acute osteomyelitis.

Blood flow and blood pool images were normal. Images at 3 hrs after administration of Tc-99m-HDP are shown on Figures 1–4.

On delayed images there is abnormal symmetrical "blurry appearance" of the proximal, diaphyseal growth plates in both humeri and proximal growth plates of both tibiae. The uptake in the spine is nonhomogeneous without definite focal abnormalities. Foci of high tracer uptake are seen in the sternal manubrium and intertrochanteric area of the right femur.

Focal bony abnormalities could be due to multifocal acute osteomyelitis, but normal blood flow and blood pool images make acute osteomyelitis less likely. We thought that the abnormal, symmetrical appearance of the growth plates, may represent generalised bone marrow involvement, as in lymphoma.

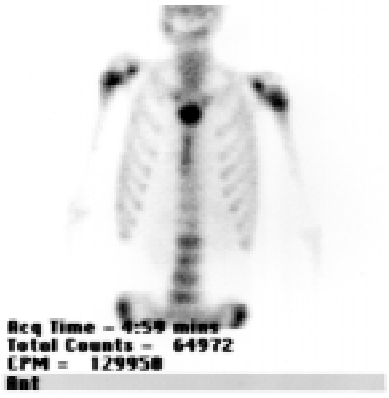

Figure 1. Anterior thorax.

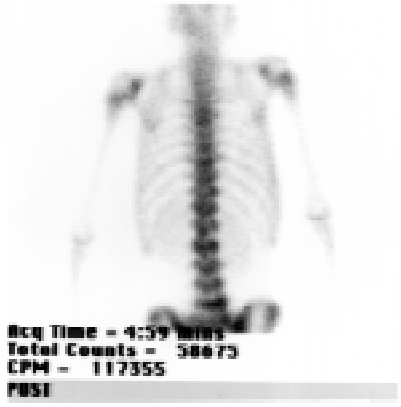

Figure 2. Posterior thorax.

Figure 3. Anterior hips and knees.

Figure 4. Posterior hips and knees.

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What is the diagnosis?

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The answer to this question is: diagnosis – neuroblastoma with diffuse bone marrow involvement

Scintigraphic evaluation of bone involvement in neuroblastoma

Bilateral bone marrow biopsies were positive for neuroblastoma. MRI showed a primary, para-spinal tumour, which was resected. The patient is undergoing chemotherapy and she is awaiting a stem cell transplant.

Neuroblastoma accounts for 7–10% of pediatric malignancies and is the most common solid neoplasm outside CNS. It typically arises in the adrenal medulla or paravertebral regions of the abdomen or thorax along the sympathetic chain. It spreads to lymph nodes, cortical bone and bone marrow, liver, lungs and subcutaneous tissue. On bone scans there is soft tissue accumulation of the tracer in the primary tumour in 30––85% of the patients. Bone metastases [1–5] typically present as multiple areas of increased uptake adjacent to metaphyses of the long bones. Most often in the proximal humeri, distal femora and proximal tibiae. Involvement of the skull, vertebrae, ribs and pelvis is also common. The distribution of bone lesions is usually asymmetric. Occasionally metastatic neuroblastoma can present as symmetrical loss of normal shape, "blurry appearance" of the metaphyseal growth plates of the long bones. A similar pattern is sometimes seen in acute leukemia and it may represent diffuse bone marrow involvement. The metaphyseal uptake as well as occasional lytic bone lesions may be difficult to evaluate. In one study bone scans were shown to be less sensitive than radiographs for detection of neuroblastoma metastatic to the bones [1], but many other studies showed that bone scans were much more sensitive than radiographs [3–5]. Bone scans are routinely done for staging of this disease. Sometimes a diagnosis of neuroblastoma is made in children undergoing bone scan for another condition. Fever and bone pain can be the initial symptoms of neuroblastoma and a bone scan may be done to evaluate for osteomyelitis [6]. Metaiodobenzylguanidine labelled with I123 or I131 is very useful for evaluation of soft tissue metastases from neuroblastoma [7]. It was found to be equally accurate as bone scans, for evaluation of bone involvement in some studies [8], but less sensitive in others [9, 10]. Bone marrow biopsy is routinely done to evaluate bone marrow involvement, but it can miss focal disease. MRI is a sensitive test for bone marrow involvement with neuroblastoma, but it is less specific than MIBG. The response of bone and bone marrow lesions to chemotherapy is better evaluated with MIBG than MRI [11] or bone scans [7].

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