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Hemivertebral "Disappearance" on Bone Scan

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Two cases are described in which there was absence of uptake in a hemivertebra on a Tc-99m methylene diphosphonate bone scan. In one of these patients, the bone image had been normal 56 days previously. Radiographs of the vertebrae were normal in both cases. Data are presented suggesting that the findings can most probably be explained in terms of compromise of blood supply to the hemivertebra; each half of a vertebra usually has a separate arterial contribution.

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The usual finding with lesions in bone is increased accumulation of Tc-99m phosphates. However, instances of decreased uptake have been seen (as in aseptic necrosis) (*1*,*2*). We have noted two cases with the similar finding of hemivertebral "disappearance" or absence of activity on a bone scan.

CASE REPORTS

Case 1. A 74-year-old man was studied because of the diagnosis of carcinoma of the apex of the right lung. A bone scan on June 4, performed with Tc-99m MDP, did not reveal any abnormality in the vertebral column (Fig. 1, top). Resection of the lung lesion was carried out on July 1. He was well for 4 wk postoperatively, then developed signs and symptoms of a cord lesion at approximately T-11. A repeat bone scan on July 30, showed "disappearance" of a hemivertebra at about T-11. That is, on June 4 the whole vertebral body was seen on a bone scan, whereas 56 days later half of the vertebra did not accumulate radiotracer. The radiograph (Fig. 2) did not reveal any defects.

Case 2. At age 3.5, this boy was diagnosed as having Stage 4 neuroblastoma. After initial surgery (for tumor in the region of the paraspinal ganglia), he was treated with chemotherapy. A bone scan at age 5 showed slightly less uptake in the left side of a lower thoracic vertebra. This finding was more pronounced on bone scans done at ages 6.5 and 7.5 yr (the latter is shown in Fig. 3). The youngster did not have cord symptoms, and there were no radiographic changes noted in the region. For example, a vertebral radiograph at age 5 (Fig. 4), taken after the bone scan, did not reveal any defects. Repeat radiographs have also been normal.

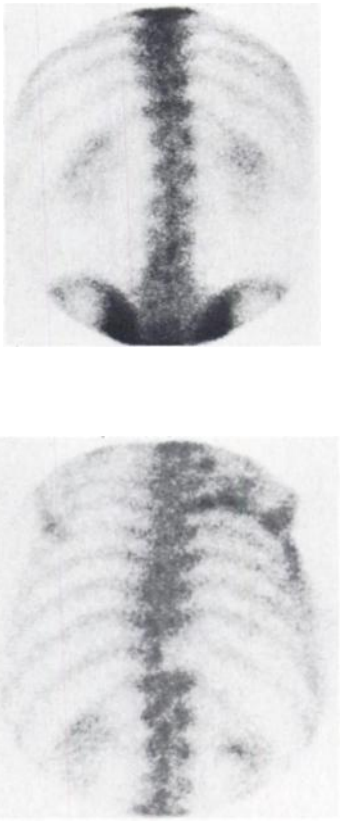

FIG. 1. Posterior images in Case 1. Top: original study (Tc-99m MDP) shows the vertebral bodies to be intact. Bottom: study 56 days later reveals that right hand half of vertebral body (~T-11) did not accumulate radiotracer. Activity in ribs on right can be seen.

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FIG. 2. Radiograph of vertebrae in Patient 1, taken 1 day after bone scan demonstrated "hemivertebral disappearance." No defects are apparent.

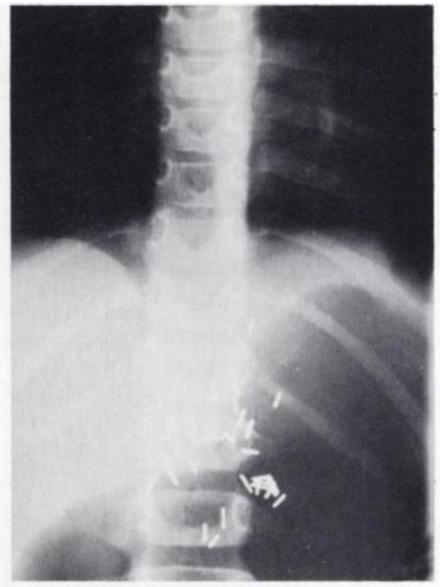

FIG. 4. Vertebral radiograph in Case 2, taken after bone scan had shown a hemivertebral defect at age 2. No abnormalities are noted. Repeat radiographs have remained within normal limits.

DISCUSSION

Photon-deficient areas on bone scans may have several causes. For example, surgical removal of bone will often produce a characteristic defect (*3*), overlying absorber also has to be ruled out. In our two cases both of these causes can be excluded because of the normal physical examination in the affected regions and because of the continuing normal radiographs. We must then consider two additional possibilities: tumor within the bone, or compromise of the blood supply. Multiple myeloma is perhaps the most widely recognized tumor that produces photon-deficient areas. In neuroblastoma (Case 2) photon-deficient areas are rare on bone scans (one out of 29 cases described by Howman-Giles and coworkers, *4*). Tumor within bone does not appear likely in our cases.

FIG. 3. Posterior image (Tc-99m MDP) in Case 2. Left side of a lower thoracic vertebra has markedly decreased uptake compared with other half.

There is a compelling reason for this. Radiographs of the affected vertebrae have been normal in both patients. Indeed, in Case 2 (less severely involved), the radiographs have remained normal for 4 yr. For tumor to be present in the bone, and to account for the findings, there must have been no progression over this long period. The long temporal stability of the bone scan, and the lack of radiographic alterations, make another cause appear more likely. This more likely cause is the compromise of blood supply to part of the vertebra. We can attempt to understand the finding of hemivertebral "disappearance" on a bone scan by referring to Fig. 5, drawn from anatomic descriptions (*5,6*). Segmental arteries carry blood to the vertebral column. Each of these supplies only one half (right or left) of a vertebra. The segmental vessels give off ascending and descending branches to comprise a network of blood vessels to the vertebral column. A spinal branch, B, from the dorsal continuation, D, sends twigs to the spinal cord and the vertebral body. The latter twigs join small vessels coming in from the segmental artery. In Case 1, there was loss of hemivertebral uptake of radiotracer, as well as spinal-cord symptoms. Compromise of the blood supply to the segmental artery and the spinal

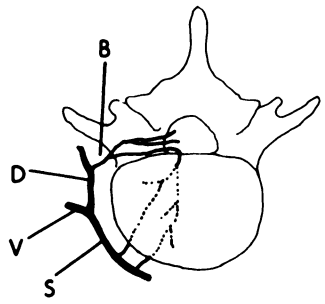

FIG. 5. Diagram of blood supply to a vertebra. Segmental artery (S) supplies vessels to only half of the body. There are also connections to vessels at the upper and lower vertebral levels; V is ventral continuation while D is dorsal vessel. Spinal branch (B) gives arteries to both the spinal cord and to the vertebra. Vertebral branches meet vessels coming from segmental artery (S).

branch must have occurred. An abnormality of the venous plexes cannot be entirely ruled out, but appears less likely because the venous supply is more diffuse. In Case 2, the hemivertebra had not completely "disappeared" on the bone scan, and there were no cord symptoms. It is probable that the spinal branches of the artery (B) were patent, although small vessels from the segmental artery itself (to the vertebra) may have been obstructed. Damage to vessels could have occurred at the time of his exploratory surgery or by tumor involving the vasculature before it entered bone. Unusual images have also been noted, produced by tumor compromising the blood supply to the spleen and to a bone growth plate (*7,8*). The two patients presented here probably represent instances of relative devascularization of bone. There was decreased accumulation of bone tracer, in a specific anatomic locale, but without radiographic findings.

ACKNOWLEDGMENT

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Tc-99m HIDA Scintigraphy in Segmental Biliary Obstruction

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Segmental biliary obstruction as a result of primary or secondary hepatic malignancy has been reported with increasing frequency. For two representative patients, the clinical and Tc-99m HIDA scintigraphic findings in segmental biliary obstruction are described. The presence of photon-deficient dilated bile ducts in one segment of the biliary tree is highly suggestive of localized biliary obstruction and should be considered in the patient with suspected or proven hepatic malignancy despite the absence of jaundice.

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Segmental obstruction of single or multiple portions of the biliary tree is a frequent sequela of primary or metastatic tumor involving the liver. Because this group of patients is often anicteric, they are well suited for hepatobiliary scintigraphy with Tc-99m HIDA or the newer N-substituted iminodiacetic acid derivatives. To date we have seen five cases of segmental obstruction of the biliary tract diagnosed with Tc-99m HIDA. Two representative cases are presented.

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CASE REPORTS

Case 1. A 50-year-old man presented with right upper quadrant pain and weight loss. Direct serum bilirubin was 0.24 mg/dl, total serum bilirubin 0.95 mg/dl (normal < 1.5 mg/dl), and serum alkaline phosphatase 90 IU/l (normal < 80 IU/l). Scintigraphy was performed with Tc-99m HIDA (dimethyl-IDA) following the intravenous injection of 5 mCi of tracer. Images (700,000 counts) were obtained, with a gamma camera and a high-resolution collimator, at 5-min intervals to 1 hr and at 2, 4, and 24 hr after injection. The Tc-99m HIDA scintigram demonstrates a photon-deficient branching structure in the left lobe of the liver, with normal excretion into minimally prominent ducts in the right lobe (Fig. 1). Delayed views did not reveal "filling in" of this dilated duct. Transmission computerized tomography confirms the presence of obstruction of the left biliary ducts as well as identifying a low-density mass anterior to the pancreas (Fig. 1). At surgery, a hepatoma was found occluding biliary drainage of the