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Postgastrectomy osteomalacia with pseudofractures assessed by repeated bone scintigraphy

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A patient with osteomalacia secondary to vitamin D deficiency after gastrectomy for gastric cancer is presented. Initial bone scintigrams showed both asymmetric and symmetric focal areas of intense uptake due to pseudofractures reminiscent of bone metastases. Radiographs only confirmed the presence of pseudofractures at some, but not all, of the abnormal sites demonstrated by bone scintigraphy. At first, metastatic bone disease was suspected. However, the appearance of repeated bone scintigram was normalized after treatment with vitamin D. A diagnosis of osteomalacia was established. The present case serves to illustrate that symmetric focal lesions are important features of pseudofractures secondary to osteomalacia, and comparison with radiographs and repeated bone scintigraphy are necessary in distinguishing between bone metastases and pseudofractures.

Key words: osteomalacia, ^{99m}Tc-HMDP, bone scintigraphy, gastrectomy

INTRODUCTION

OSTEOMALACIA occurs when calcium salts fail to be deposited promptly on the organic bone matrix. An increased incidence of osteomalacia in gastrectomy patients has been reported.[1,2] The precise diagnosis of osteomalacia relies on abnormal biochemical findings and pseudofractures on radiographs, and definite diagnosis rests on the biopsy findings.

Bone scintigraphy has been shown to play a useful role in the detection of osteomalacia,[3–6] and the scintigraphic appearance is characterized by generalized increased skeletal uptake, prominent costochondral junctions, enhanced periarticular uptake, and focal intense uptake in the sites of pseudofractures. If pseudofractures are asymmetrically distributed, the scintigraphic appearance mimics that of metastatic bone diseases.[5]

We here present a typical case of a postgastrectomy patient whose underlying disease was gastric cancer, in whom an initial bone scintigram showed both asymmetric and symmetric focal areas of intense uptake due to pseudofractures simulating metastatic bone disease. These scintigraphic appearances subsequently returned to normal on a repeated bone scintigram after treatment with vitamin D. From this case report, we chiefly emphasize the non-specificity of a bone scintigram, the necessity of correlating scintigraphic abnormalities with radiographic findings, and the usefulness of repeated bone scintigraphy in distinguishing between bone metastases and pseudofractures.

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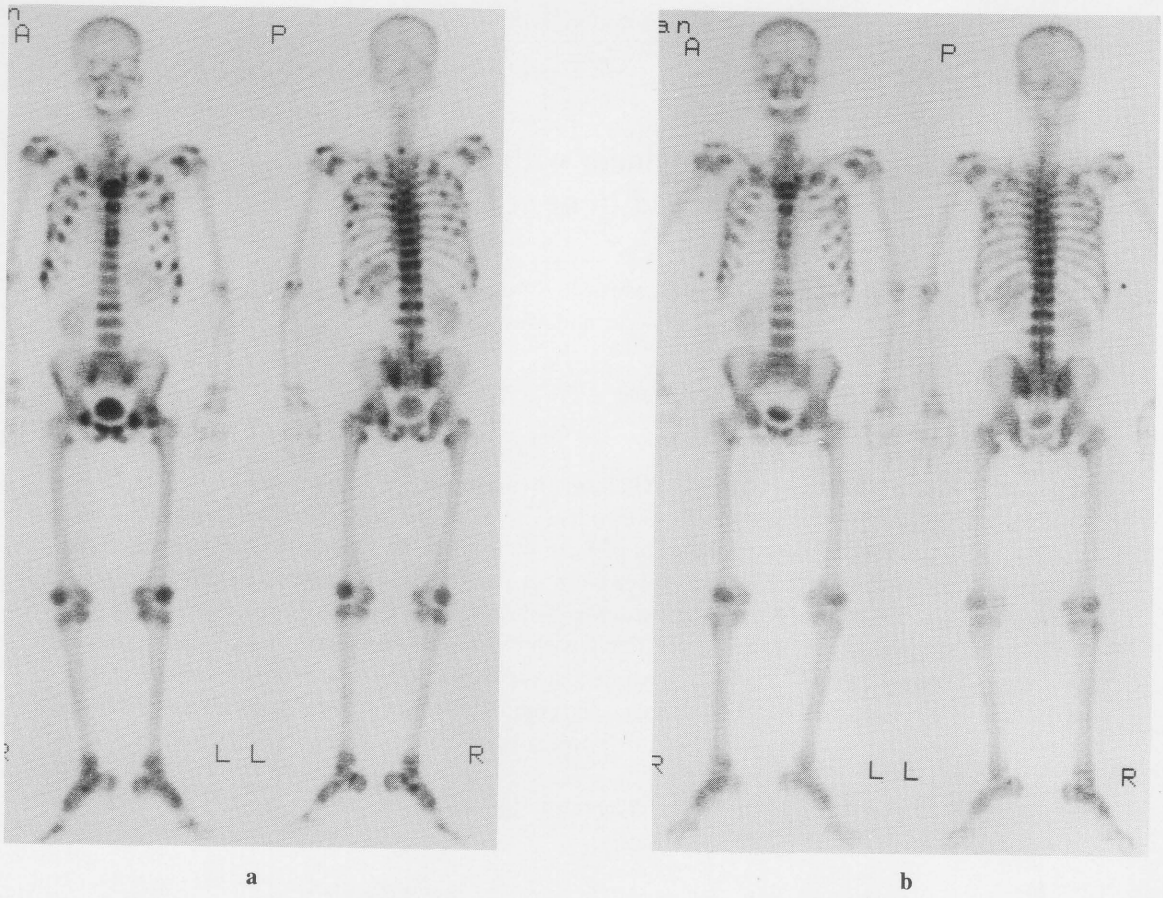
CASE REPORT

A 52-year-old man was admitted to our hospital in September, 1992 with complaining chiefly of lumbago and leg muscle weakness with pain. He had a history of complete gastroduodenostomy, total pancreatomy and cholecystectomy for carcinoma of the stomach 5 years prior to admission. Since January, 1992 he had complained of increased muscular weakness, generalized muscle and bone pain mainly affecting his lower back and limbs, and had developed difficulty in walking at the time of admission. Physical examination revealed muscle atrophy, sensory deficit of the lower limbs and a state of malabsorption.

Admission laboratory data were as follows: Ca 8.2 mg/dl (normal 8.6–10.2), IP (PO4) 2.9 mg/dl (normal 2.2–4.5), Alp 147.8 KAU (normal 2.4–6.0), Alb 3.3 g/dl (normal 4.3–5.4), GOT 80 KU (normal 6–26), GPT 88 KU (normal 4–32), CEA 6.4 ng/ml (normal < 5.0), PTH



a b

Fig. 1 Whole body bone scintigrams (a), before treatment, reveal generally increased uptake of the tracer throughout the skeleton including the periarticular areas, with the kidneys only faintly visualized. There are symmetric focal areas of increased uptake in the pubic rami, ischia and upper femora. In addition, multiple other sites of increased uptake asymmetrically distributed in the ribs, spine and neck of left femur are also present. (b), after treatment with vitamin D, marked improvement is seen.

420 pg/m*l* (normal 150–500), BUN 14 mg/d*l* (normal 8–22), Cre 0.6 mg/d*l* (normal 0.6–1.2), 25-$(OH)_2$ Vitamin D 10 ng/m*l* (normal 10–55) and 1,25-$(OH)_2$ Vitamin D 15 pg/m*l* (normal 20–76).

Bone scintigraphy with 740 MBq of ^{99m}Tc-HMDP was performed to exclude the presence of bone metastases. Whole body scintigrams of the anterior and posterior views were acquired three hours after injection of the tracer. The bone scintigram demonstrated generally increased uptake of the tracer throughout the skeleton, especially in the periarticular areas including the shoulder, sacroilium, knee and ankle joints, with high contrast between bone and soft tissue, with the kidneys only faintly visualized. There were symmetrically distributed focal areas of increased tracer uptake in the pubic rami, ischia and upper femora. In addition, there were multiple other sites of increased uptake asymmetrically distributed in the ribs, spine and neck of the left femur (Fig. 1a).

Radiographs of the pelvis and chest revealed generalized demineralization and several pseudofractures in the neck of the left femur, both superior and inferior pubic rami (Fig. 2a), and in the left 11th rib, corresponding to some, but not all of the sites of abnormalities detected by bone scintigraphy. The lumbar BMD measured by DEXA was also moderately decreased (L2–L4: 0.67 g/cm^2).

At first, metastatic bone lesions superimposed on metabolic bone disease could not be entirely excluded, because multiple asymmetrically distributed bony lesions, which were not seen all on radiographs, were detected by bone scintigraphy. But the patient's symptoms improved following vitamin D treatment. After 5 months, laboratory data showed some improvement as follows: Ca was 8.7 mg/d*l* (normal 8.6–10.2), IP (PO4) 3.5 mg/d*l* (normal 2.2–4.5), Alp 34 KAU (normal 2.4–6.0), 25-$(OH)_2$ Vitamin D 10 ng/m*l* (normal 10–55) and 1,25-$(OH)_2$ Vitamin D 19 pg/m*l* (normal 20–76). A repeated bone scintigram demonstrated substantial normalization of tracer distribution, with obvious reduction in the avidity of the tracer uptake at the sites of pseudofractures (Fig. 1b), which had showed intense uptake on the initial study. At the same time, a repeated radiograph of the pelvis showed normal findings (Fig. 2b) and the lumbar BMD was also signifi-

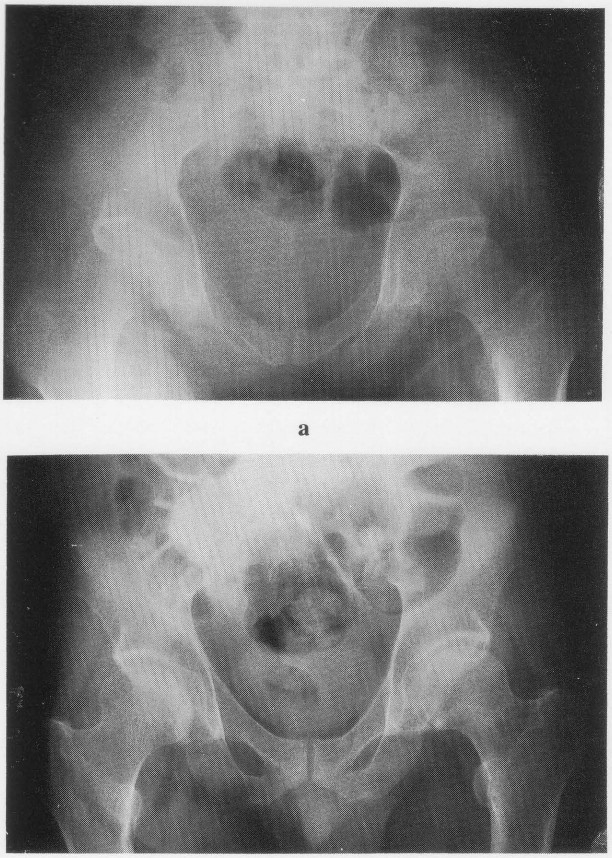


Fig. 2 Radiographs of pelvis (a), before treatment, demonstrates generalized demineralization and pseudofractures in the neck of the left femur, both superior and inferior pubic rami. (b), after treatment, marked improvement is seen.

cantly improved (L2–L4: 0.87 g/cm^2). Bone metastases could be completely excluded by these findings, and a diagnosis of osteomalacia after gastrectomy was established based on the pseudofractures on the radiographs and the patient's response to vitamin D therapy.

DISCUSSION

Osteomalacia is defined as significant replacement of normal trabecular bone by unmineralized osteoid, as a result of a defect in bone mineralization. In most cases, vitamin D deficiency, and consequently diminished calcium absorption, is the underlying cause. Bisballe et al. reported that 18% of postgastrectomy patients had osteomalacia, and in 24–62% of patients there were other abnormalities of bone remodelling depending on the parameter studied.[2] It has been considered that a definite diagnosis of osteomalacia requires biopsy demonstration of wide osteoid seams.[7] However, bone biopsy is an invasive technique, which limits its clinical application.

The limited value of serum biochemical results in a diagnosis of osteomalacia, as was clearly shown in a previous study,[2] especially since no significant correlations to histomorphometry were demonstrable for 1,25-$(OH)_2$ Vitamin D or phosphate. Most postgastrectomy osteomalacia showed increased serum concentrations of 1,25-$(OH)_2$ Vitamin D, but normal or even decreased serum concentrations of 1,25-$(OH)_2$ Vitamin D also have been noted in some cases of late stages or accompanied by severe malabsorption, which may reflect differences in 1-α-hydroxylase activity or different degrees of 25$(OH)_2$ Vitamin D depletion.[2,8] The present case, in which renal function and serum PTH were normal, showed decreased serum concentrations of 1,25-$(OH)_2$ Vitamin D, probably due to severe malabsorption and advanced osteomalacia at the time of admission.

Nuclear medicine procedures have been used in the investigation of metabolic bone disease including osteomalacia. We recently reported that simultaneous measurements of 24-h whole body retention of ^{47}Ca-chloride and ^{99m}Tc-MDP facilitated the early differentiation of osteomalacia in animal models prior to the detection of radiological bone changes.[9] Several abnormal patterns on bone scintigrams have been reported in patients with osteomalacia, and the scintigraphic appearances have been well described as generalized increased uptake by the skeleton including the periarticular sites, costochondral junction, sternum, and focal uptake by the areas of pseudofractures.[3–6] But these appearances are often nonspecific and can be found in other pathologic conditions. As in our case, both symmetric and asymmetric focal intense uptake were shown. The focal increased uptake of the tracer in the ribs, neck of the left femur, thoracic and lumbar spine were random and asymmetric, reminiscent of bone metastases. Since both metastatic bone disease and osteomalacia are relatively common in postgastrectomy patients with known malignancy, it is important to distinguish between them in the planning of treatment.

The present case illustrates the importance of the following features in distinguishing between osteomalacia and bone metastasis. First, symmetric focal lesions are important features of osteomalacia. A symmetric distribution of the tracer is rarely seen in bone metastases. Singh et al. have suggested that the presence of symmetric focal lesions should make one suspicious of the possibility of osteomalacia even in the face of asymmetric focal lesions reminiscent of bone metastases.[10] In addition, one does not see generalized increased uptake by the skeleton in bone metastases, unless there is diffuse involvement caused by the malignant disease. Second, radiographic correlation is essential in order to avoid a misdiagnosis of metastasis. Bone scintigraphy is more sensitive in detecting pseudofractures than radiography.[3,5] As in our patient, many more lesions are seen on bone scintigram than are visible radiologically. However, the presence of pseudofractures on the radiograph makes the diagnosis of osteomalacia more likely even if they are few, because pseudofractures are a recognized feature of osteomalacia.

In addition, other adequate clinical information also may be available during the reading of the bone scintigram in postgastrectomy patients. Third, repeated bone scintigraphy after treatment with vitamin D should also help to differentiate between osteomalacia and bone metastases in postgastrectomy patients with known malignancy, because one would not expect bone abnormalities of metastases to disappear during vitamin D therapy, and treated osteomalacic patients show improvement on a bone scintigram, as occurred in our patient.

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