99mTc-tetrofosmin uptake in bone metastases from breast cancer

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^{99m}Tc-tetrofosmin uptake in bone metastases from breast cancer

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^{99m}Tc-tetrofosmin myocardial imaging was performed in a 62-year-old woman who had undergone standard radical mastectomy for right breast cancer 6 years ago. Although the result was negative for the ischemic heart disease, it showed abnormal accumulation corresponding to the bone metastases in the spine. We believe that ^{99m}Tc-tetrofosmin imaging is helpful in detecting bone metastases from breast cancer.

Key words: ^{99m}Tc-tetrofosmin, breast cancer, bone metastasis, ^{99m}Tc-MDP

INTRODUCTION

MANY AUTHORS have reported that ^{99m}Tc-tetrofosmin is useful as tumor-seeking agent for lung,[1–6] breast,[7–10] thyroid[11–14] and other malignant tumors.[15–20] In some cases, not only the primary lesion but also its lymph node metastases were delineated in patients with lung cancer, thyroid cancer and breast cancer, but there is no report on the visualization of bone metastases from breast cancer. We present a case of high tracer uptake in bone metastasis from breast cancer.

CASE REPORT

A 62-year-old woman underwent standard radical mastectomy for right breast cancer (infiltrating ductal carcinoma) 6 years ago. In the follow-up, she complained of the left chest pain. Hematological examination revealed a gradual increase in serum carcinoembryonic antigen (CEA) and it reached 11.1 ng/m*l* (normal, <10 ng/m*l*). Physical examination, radiographic examination and electrocardiogram (ECG) showed no significant finding. In order to rule out ischemic heart disease, ^{99m}Tc-tetrofosmin myocardial imaging was performed with a gamma camera (Starcam 400AC/T, General Electric, Milwaukee, USA) equipped with a low-energy all purpose parallel-hole collimator. Fifteen minutes after the intravenous injection of 740 MBq ^{99m}Tc-tetrofosmin, an anterior thoracic planar image (512 × 512 matrix, 1500 kcounts) was acquired. The energy discriminator was centered on 140 keV with a 20% window. Subsequently single photon emission computed tomography (SPECT) data were acquired in thirty-two projections images of 15 sec each in an 180° arc extending a 30° right anterior oblique (RAO) to the left posterior oblique (LPO) projection (nearly 200 kcounts per pixel). All data were prefiltered with a Hanning filter with a cutoff frequency of 0.8 cycles/pixel. Myocardial SPECT images were reconstructed by means of a filtered backprojection algorithm and Ramp filter. No attenuation or scatter correction was performed. Since abnormal tracer accumulation was suspected in the middle lower chest on the anterior planar image, posterior planar images (256 × 1024 matrix, 1500 kcounts) and SPECT images with 360° rotation were repeatedly acquired (Fig. 1). The SPECT images clearly showed intense tracer activity in a location corresponding to the spine (Fig. 2). ^{99m}Tc-MDP scintigraphy showed increased uptake in the left first rib, the 7th and 8th thoracic vertebrae, the right 8th rib and the right sacroiliac joint, indicating multiple bone metastases from breast cancer (Fig. 3). X-ray CT, which was performed to exclude lung and lymph node metastases, delineated osteolytic changes in the right sacroiliac joint and the right rib with a surrounding small soft tissue density mass (Fig. 4). To our great surprise, the thoracic vertebral lesion was very faint on the CT image. No histological examination of the left first rib has been

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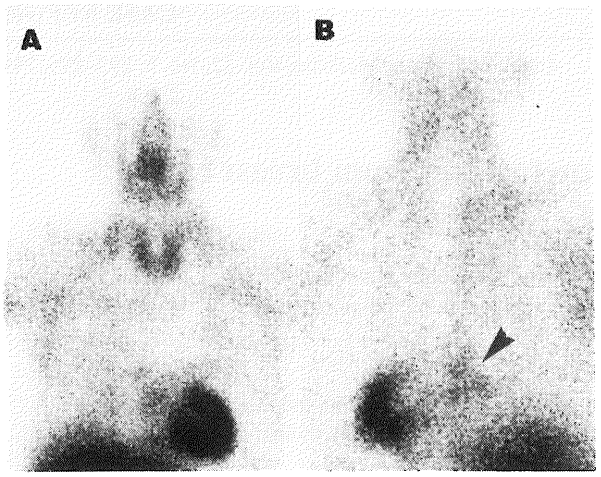

Fig. 1 ^{99m}Tc-tetrofosmin thoracic planar image shows increased tracer uptake (arrowhead) in the middle lower chest (anterior, A and posterior, B).

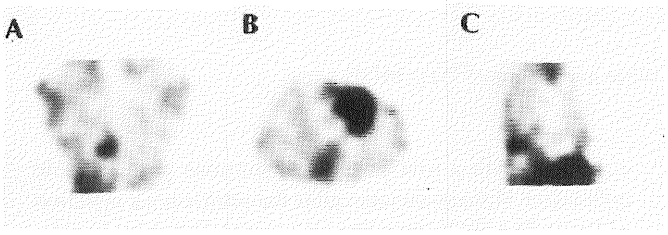

Fig. 2 Thoracic SPECT images clearly show intense tracer activity corresponding to the spine (coronal, A, transaxial, B, and sagittal imaging, C).

performed and a review of the CT image did not provide any useful information on this bone.

DISCUSSION

The tumor-seeking properties of ^{201}Tl and ^{99m}Tc-methoxybutylisonitrile (MIBI) are well known. Compared with ^{201}Tl, ^{99m}Tc has some advantages such as higher proton energy and a shorter half life, resulting in a smaller radiation dose, larger injected dose and better image quality. Furthermore, as an alternative to ^{99m}Tc-MIBI, ^{99m}Tc-tetrofosmin is currently used for myocardial perfusion imaging due to its rapid clearance from both the lungs and liver, resulting in earlier high-quality myocardial images.

^{99m}Tc-tetrofosmin uptake in malignant tumors has been demonstrated by various authors.[1–20] Some authors reported that not only the primary lesion but also its lymph node metastases were delineated. Schillaci et al.[5] reported ^{99m}Tc-tetrofosmin accumulation in a patient with lung cancer (adenocarcinoma) and its brain and mediastinal lymph node metastases. Kosuda et al.[11] reported a case of follicular thyroid carcinoma in which lung, bone and

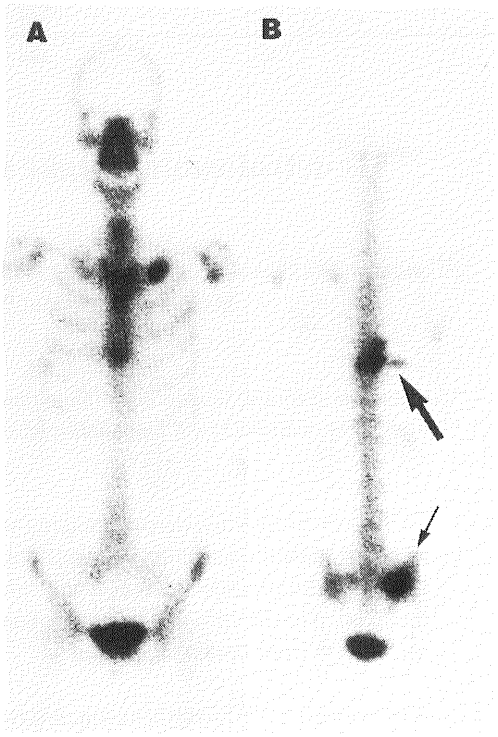

Fig. 3 ^{99m}Tc-MDP bone scintigraphy shows increased uptake in the left first rib, the 7th and 8th thoracic vertebrae, the right 8th rib (large arrow) and the right sacroiliac joint (small arrow), indicating multiple bone metastases from breast cancer (anterior, A and posterior, B).

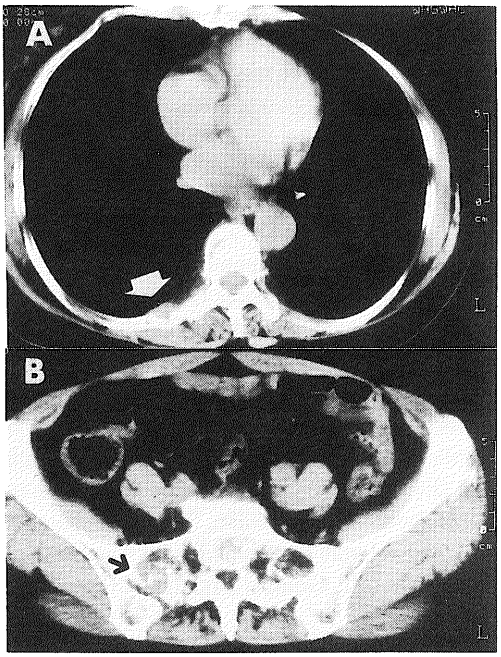

Fig. 4 X-ray CT shows osteolytic changes in the right sacroiliac joint (black arrow, B) and the right rib with a surrounding small soft tissue density mass (white arrow, A). To our great surprise, the thoracic vertebral lesion is very faint on the CT image.

lymph node metastases were delineated by both ^{99m}Tc-MIBI and ^{99m}Tc-tetrofosmin. Klain et al.[12] reported that ^{99m}Tc-tetrofosmin imaging depicted the metastases in the lymph nodes of the neck and in the chest wall, skull and spine in patients with thyroid cancer. Lind et al.[13] revealed that the overall sensitivity of ^{99m}Tc-tetrofosmin in detecting distant metastases from thyroid cancer was 86%. On the other hand, Rambaldi et al.[7] firstly reported ^{99m}Tc-tetrofosmin uptake in breast cancer and its lymph node metastases. Mansi et al.[8] demonstrated the sensitivity of 92.8% and 91.6% in ^{99m}Tc-tetrofosmin imaging for the detection of breast cancer and its axillary lymph node metastases, respectively. On the other hand, Akcay et al.[10] reported 93% (13/17) and 60% (6/17) sensitivity in the detection of breast cancer and its axillary lymph node metastases, respectively. Although ^{99m}Tc-tetrofosmin uptake in lymph node metastases was reported, there is no report on ^{99m}Tc-tetrofosmin uptake in bone metastases from breast cancer.

The precise mechanisms of uptake of ^{99m}Tc-tetrofosmin by tumor tissue has not been sufficiently elucidated, but its tumor localization may be explained on the basis of such factors as regional blood flow and mitochondrial content.[1,21] In addition, it was also reported that accumulation of this tracer in breast tumor cells *in vitro* is related to the P-glycoprotein similar to MIBI.[22]

^{99m}Tc-MDP scintigraphy is an excellent method for delineating tumor-bearing lesions in the whole body. It can be used not only in the follow-up of bone metastases from malignant tumors but also as scintimammography in detecting the primary breast cancer.[23] In this case, ^{99m}Tc-MDP scintigraphy clearly demonstrated the location of increased tracer uptake: the left first rib, the 7th and 8th thoracic vertebrae, the right 8th rib and the right sacroiliac joint. On the other hand, ^{99m}Tc-tetrofosmin imaging showed indeterminate location of increased uptake. With the help of ^{99m}Tc-MDP scintigraphy, it was considered that ^{99m}Tc-tetrofosmin accumulated in the right 8th rib as well as the thoracic vertebral lesions.

There was a discrepancy between ^{99m}Tc-MDP and ^{99m}Tc-tetrofosmin imaging on tracer uptake in the left first rib. ^{99m}Tc-tetrofosmin imaging showed no abnormality in the left first rib, whereas ^{99m}Tc-MDP scintigraphy showed greatly increased uptake. Review of the CT images did not provide any useful information on this bone. As no histological examination of the left first rib has been performed, we cannot explain the cause of the difference between the results for the two tracers. Further studies with both tracers are therefore required for assessing malignant tumors and their metastases.

In conclusion, ^{99m}Tc-tetrofosmin imaging would be helpful in detecting the bone metastases from breast cancer. Therefore, in the interpretation of ^{99m}Tc-tetrofosmin myocardial imaging, attention should be paid to excluding the presence of bone metastases.

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