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Diffuse and marked breast uptake of both ^{123}I-BMIPP and ^{99m}Tc-TF by myocardial scintigraphy

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Unexpected breast uptake was observed in a 32-year-old woman referred for evaluation of hypertrophic cardiomyopathy. Diffuse and marked bilateral breast uptake of ^{123}I-BMIPP and ^{99m}Tc-TF was shown by both planar and SPECT imaging during the first study, and the uptake of both radionuclides had decreased significantly eleven months later. At the time of the first radionuclide examination, she was occasionally breast feeding her 2-year-old child and had small amounts of milk production. At the follow up examination, the frequency of breast feeding was significantly reduced and she produced only small amounts of milk. Therefore, the uptake of ^{123}I-BMIPP and ^{99m}Tc-TF may have been caused by lactation.

Key words: breast uptake, myocardial scintigraphy, ^{123}I-BMIPP, ^{99m}Tc-tetrofosmin

INTRODUCTION

Diffuse breast uptake is occasionally observed with various kinds of radionuclide agents such as gallium-67 citrate,[1] free iodine,[2–6] technetium-99m pertechnetate,[7] ^{99m}Tc pyrophosphate,[8] and ^{99m}Tc sestamibi (MIBI).[9] The radionuclides, ^{99m}Tc tetrofosmin (TF) and ^{123}I labeled 15-(p-iodophenyl)-3-(R,S)-methylpentadecanoic acid (BMIPP), are used clinically to evaluate myocardial perfusion and myocardial fatty acid metabolism, respectively. A patient with hypertrophic cardiomyopathy (HCM) was examined with ^{99m}Tc-TF and ^{123}I-BMIPP, and marked breast uptake was observed of both cardiac radionuclides. The uptake of ^{123}I-BMIPP was particularly unexpected, and we report this case here.

CASE REPORT

A 32-year-old woman was examined with both ^{99m}Tc-TF and ^{123}I-BMIPP for evaluation of HCM. She had been diagnosed with HCM and Wolff-Parkinson-White syndrome (WPW syndrome) by echocardiography and catheterization at the age of 26. Catheter ablation was done for WPW syndrome. The physical examination and laboratory findings were normal, the serum prolactin level was less than 15 ng/m*l* (normal value) and she had no clinical signs of breast carcinoma or mastitis. At the time of the first radionuclide examination, she was occasionally breast feeding her 2-year-old child, and her baby preferred feeding on the right side. At the follow up examination performed eleven months later, the frequency of breast feeding was reduced and she produced very small amounts of milk.

On first examination, electrocardiography showed ST segment depression in aV_L, V_4–V_6 and negative T in aV_L, V_3–V_6. A chest radiogram showed mild cardiomegaly (cardiothoracic ratio: 54%) (Fig. 1). Echocardiography showed asymmetrical hypertrophy and normal left ventrical wall motion (Intraventricular wall thickness was 18 mm, posterior wall thickness was 12 mm, left ventricular end-diastolic diameter was 44 mm, left ventricular end systolic diameter was 25 mm, and fractional shortening by 43%). Breast ultrasound and magnetic resonance imaging were not done because the patient did not consent to them.

Myocardial scintigraphy was performed 15 min after intravenous injection of 148 MBq of ^{123}I-BMIPP, and 30 min after intravenous injection of 740 MBq of ^{99m}Tc-TF within one week. Data were obtained with a rotating double headed gamma camera (E.CAM; Siemens Medical System Inc.,USA) equipped with a low energy and

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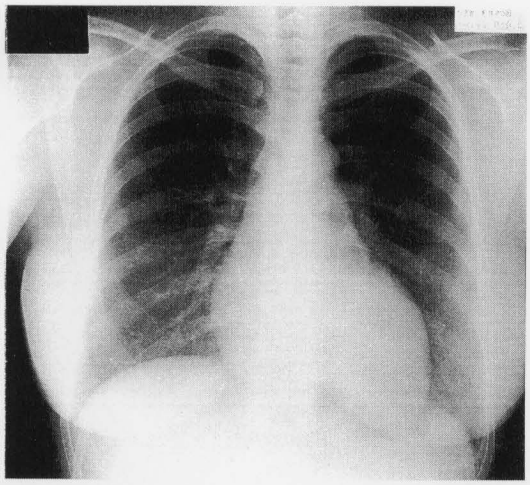

Fig. 1 Chest X ray shows slight cardiomegaly (cardiothoracic ratio: 54%).

two parallel-hole collimators. Single-photon emission computed tomography (SPECT) collected 32 projections over 180 degrees from the 45 degree right anterior oblique position to the 45 degree left posterior oblique position. Data collection time was set at 25 sec per projection for ^{123}I-BMIPP and 15 sec per projection for ^{99m}Tc-TF, and the data were recorded in a 64 × 64 matrix. SPECT images were reconstructed by filtered back projection with a Butterworth filter (Order-5, cut off frequency-0.45).

A planar myocardial scintigram was performed soon after SPECT imaging because of the marked accumulation in both breasts observed at the first examination. In ^{123}I-BMIPP imaging, the degree of accumulation in the right breast was the same as in the heart, whereas the left breast had a slightly lower uptake than the heart (Fig. 2A). In ^{99m}Tc-TF imaging, bilateral breast uptake was lower than that of the heart, and its accumulation was almost the same in both breasts (Fig. 3A). At the second examination, ^{123}I-BMIPP and ^{99m}Tc-TF myocardial scintigraphy were performed following the same imaging protocol, and bilateral breast accumulation was significantly lower than in the previous study (Fig. 2B, 3B). The breast uptake ratio normalized by the mediastinum was significantly reduced in the second examination (Table 1). In the transaxial image of both ^{99m}Tc-TF and ^{123}I-BMIPP SPECT, breast uptake was observed intense in the peripheral area and with relatively low intensity in the central area (Fig. 2C, 3C). In the septum, hypertrophy seen as high uptake of ^{99m}Tc-TF showed low accumulation of ^{123}I-BMIPP.

DISCUSSION

^{123}I-BMIPP and ^{99m}Tc-TF were noticeably accumulated in both breasts at the first examination. ^{123}I-BMIPP is used to evaluate myocardial fatty acid metabolism because of its long retention in the myocardium,[10] and abnormal accumulation of ^{123}I-BMIPP in a case of HCM is assessed

Table 1 ^{123}I-BMIPP and ^{99m}Tc-TF breast and mediastinum uptake ratio

	^{123}I-BMIPP		^{99m}Tc-TF	
	Rt	Lt	Rt	Lt
1st study	3.7	3.3	3.4	3.5
2nd study	2.0	1.7	2.2	1.6

to predict the patient's prognosis.[11] However, there are no reports of breast tissue accumulation of ^{123}I-BMIPP. The breast uptake in this patient was more intense in the peripheral area and lower in the central area. The pattern of tracer uptake is thought to be related to the distribution of glandular tissue that radiates from the nipple into the surrounding superficial fat. The degree of accumulation in breast tissue corresponded to the frequency of breast feeding and the amounts of milk produced. Growth of the mammary glands for breast feeding may therefore be related to the accumulation of ^{123}I-BMIPP in the breast, but the actual mechanism of breast uptake remains unknown. Differential diagnosis of abnormal breast uptake, which might be focal or unilateral, includes ^{123}I-BMIPP uptake by soft tissue tumors such as liposarcoma or malignant fibrous histiocytoma.[12]

^{99m}Tc-TF, a lipophilic cation diphosphine, with rapid cardiac uptake, has similar accumulation and myocardial kinetics to ^{99m}Tc-MIBI,[13] and is widely used as a myocardial perfusion agent. In this case, the intense accumulation by breast was seen even 2 years after childbirth with small amounts of milk production. Post-partum intense breast tissue accumulation was reported in a patient 6 months after delivery, and 0.0084% of the injected dose of ^{99m}Tc-MIBI was excreted in milk during first 24 hr.[9] Nevertheless, related to the serum hormonal levels, moderate bilateral or unilateral diffuse ^{99m}Tc-MIBI uptake by normal breast was also reported to occur in 5 out of 100 patients. Increased frequency of bilateral normal breast uptake was seen in the first (58%), and fourth weeks (72%) of the menstrual cycle, and decreased frequency was seen in postmenopausal patients (5%).[14,15] This case is not directly related to the menstrual cycle, but we must also consider this factor. The mechanism of breast uptake of ^{99m}Tc-TF is uncertain but it is likely to be similar to that of ^{99m}Tc-MIBI. This patient had no breast tumors, but for differential diagnosis, we must consider breast cancer because high sensitivity and high specificity were reported as 92% and 89% for ^{99m}Tc-MIBI,[16] and 91% and 94% for ^{99m}Tc-TF.[17] Benign proliferative dysplasia (diffuse accumulation) and hypercellular fibroadenoma (focal accumulation) indicated by ^{99m}Tc-TF[18] and ^{99m}Tc-MIBI[16] uptake, and chronic mastitis indicated by ^{99m}Tc-TF[19] uptake must also be considered.

Another possible reason for breast accumulation, is the presence of free $^{99m}TcO_4^-$ and free radioiodine with ^{123}I since these radionuclides accumulate in the breast.

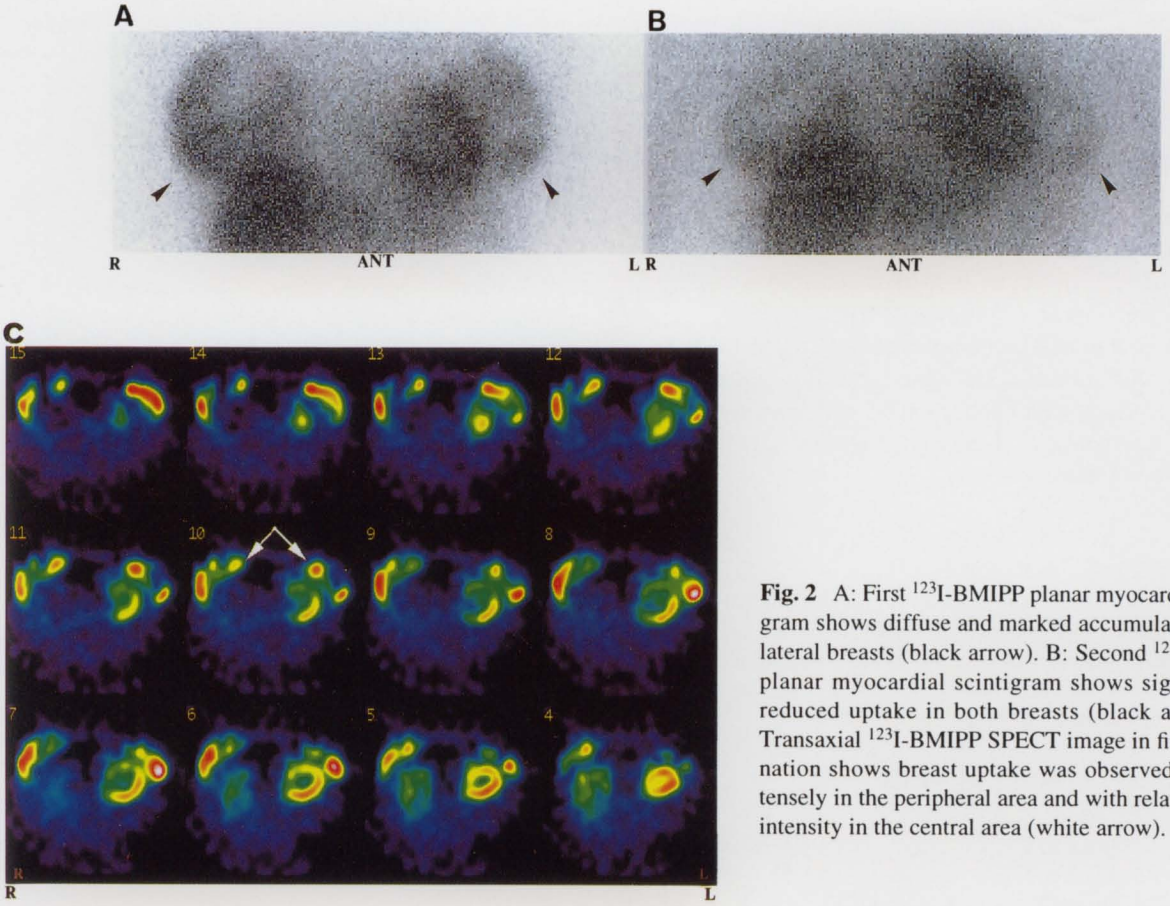

Fig. 2 A: First ^{123}I-BMIPP planar myocardial scintigram shows diffuse and marked accumulation in bilateral breasts (black arrow). B: Second ^{123}I-BMIPP planar myocardial scintigram shows significantly reduced uptake in both breasts (black arrow). C: Transaxial ^{123}I-BMIPP SPECT image in first examination shows breast uptake was observed more intensely in the peripheral area and with relatively low intensity in the central area (white arrow).

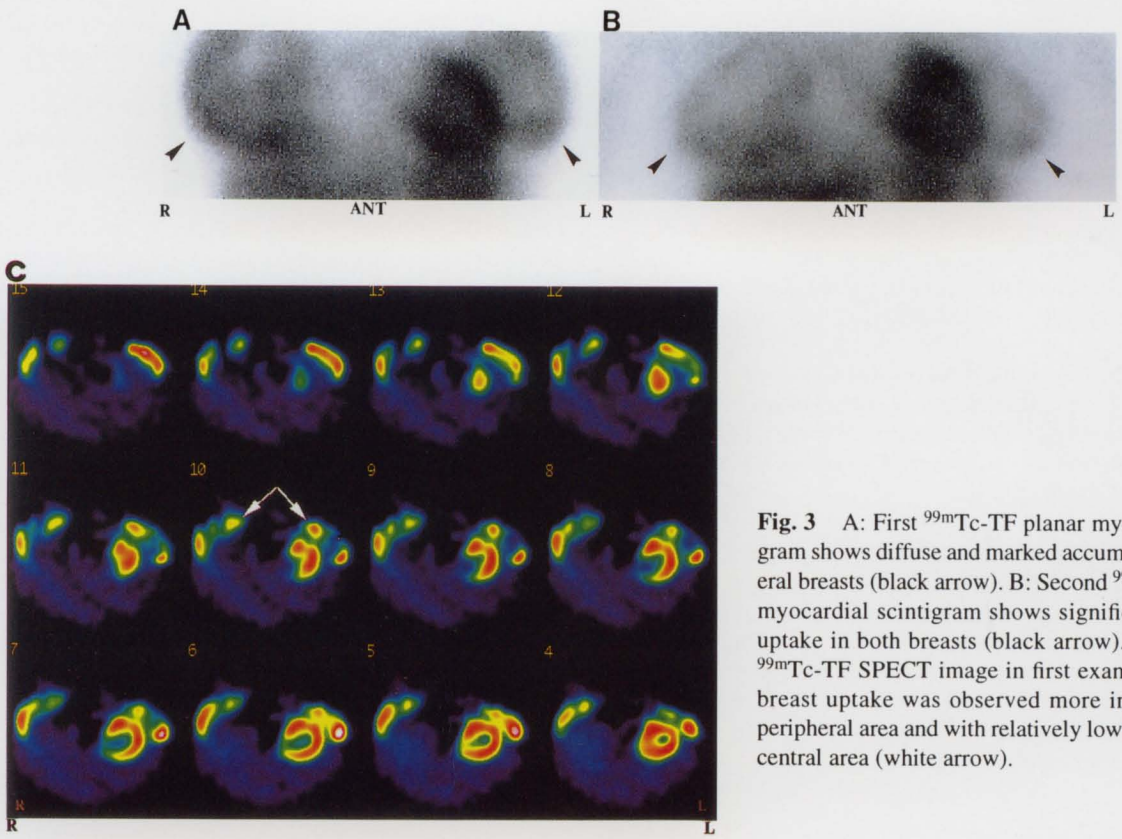

Fig. 3 A: First ^{99m}Tc-TF planar myocardial scintigram shows diffuse and marked accumulation in bilateral breasts (black arrow). B: Second ^{99m}Tc-TF planar myocardial scintigram shows significantly reduced uptake in both breasts (black arrow). C: Transaxial ^{99m}Tc-TF SPECT image in first examination shows breast uptake was observed more intensely in the peripheral area and with relatively low intensity in the central area (white arrow).

Iodine-123 uptake by mammary glands, the mechanism of which is not known, occurs in both lactating and non lactating women[2–4] and is commonly seen in the early postpartum period associated with high prolactin levels.[3] Nevertheless, the amount of free iodine in ^{123}I-BMIPP is reported to be very small (less than 5%), and increased activity in the thyroid and stomach, which is a sign of free radioiodine and free technetium, was not observed in this case, so that the uptake by the breast is not likely to be caused by free iodine-123 or free $^{99m}TcO_4^-$.

We reported marked accumulation of ^{123}I-BMIPP and ^{99m}Tc-TF in the breast. Because the follow up study showed decreased radionuclide uptake with both imaging methods, the uptake of these radionuclides might have been caused by breast feeding.

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