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Scintigraphic Detection of Small Breast Carcinomas

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= 국문 초록 =

핵의학 유방영상법을 이용한 작은 유방암 진단

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핵의학적 유방영상법은 오랜동안 시범되어 왔지만 임상에서 큰 역할을 못했고, 근래에 핵의약품과 핵의학기기 사용방법의 발전으로 scintimammogram(SM)이 다시 각광을 받게 되었다. 유방암 진단에 대한 핵의학영상법의 특이도와 예민도가 방사선 유방촬영법보다 높다고 보고되었으나 1cm보다 작은 유방암은 SM에 용이하게 발견되지 않는다. 본 보고에서는 1cm보다 작은 유방암이 발견된 두 증례를 발표한다.

한증례는 ^{99m}Tc MDP를 수술전 골영상을 위해서 사용하였고, 두 번째 증례는 비촉지 유방종괴를 ^{99m}Tc MIBI로 유방촬영 하였다.

Key Words : scintimammography, mammography, breast cancer

INTRODUCTION

In 1995, approximately 182,000 women in the United States were diagnosed with breast cancer and 46,000 women died of the disease[1]. Breast carcinoma is the most common malignancy among American women; one out of every eight women in the U.S. will develop the disease[2, 3]. In Korea, it is the third common tumor among women followed by carcinoma of the cervix and uterine cancer. Currently, conventional x-ray mammography (CM) is the sole imaging modality accepted for breast cancer screening. CM has a high sensitivity for detecting breast abnormalities but CM is often unable to distinguish between benign and malignant lesions. As a result, approximately 700,000 breast biopsies are performed in the U.S. each year. Only a quarter of the biopsies performed reveal carcinoma with the majority resulting in unnecessary surgery[4-7].

Scintimammography (SM) has been sporadically and unsuccessfully used for the detection of breast carcinoma since the early 1970s utilizing various radionuclides[8-12]. Recently, however, there has been renewed interest in SM using a few methodological innovations such as prone lateral imaging, early post injection imaging and the use of ^{99m}Tc labeled radiopharmaceuticals[13-15]. Although SM is still in the investigational stage, researchers have shown that SM does improve both sensitivity and specificity of breast abnormalities discovered by CM. However, reports have implied that dete-

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ction of lesions smaller than 1cm by SM have not been successful[12-15]. The following two case reports demonstrate the ability to detect small breast carcinomas using ^{99m}Tc-MIBI and ^{99m}Tc-MDP scintimammograhpy.

CASE REPORTS

Patient 1

The first case involves a 57 year-old woman whose screening mammogram discovered two suspicious lesions in the upper outer quadrant of the right breast(Fig. 1). Biopsy was recommended. Prior to biopsy, a bone scan was requested. While waiting for the bone scan after injection of ^{99m}Tc-MDP, simultaneous prone lateral images of both breasts were obtained with the patient in the prone position on a "breast imaging table". Imaging was acquired for 10 minutes, 10 minutes after the injection of 25 mCi of ^{99m}Tc-MDP, using a dual detector camera. SM of the right breast revealed two discrete areas of increased MDP uptake in the upper outer quadrant corresponding to the mammographic finding(Fig. 2). The surgical pathology report following mastectomy revealed a 2.5 ×1.5×2.5cm invasive intraductal carcinoma and a 0.5×0.7×0.8cm intraductal carcinoma in situ.

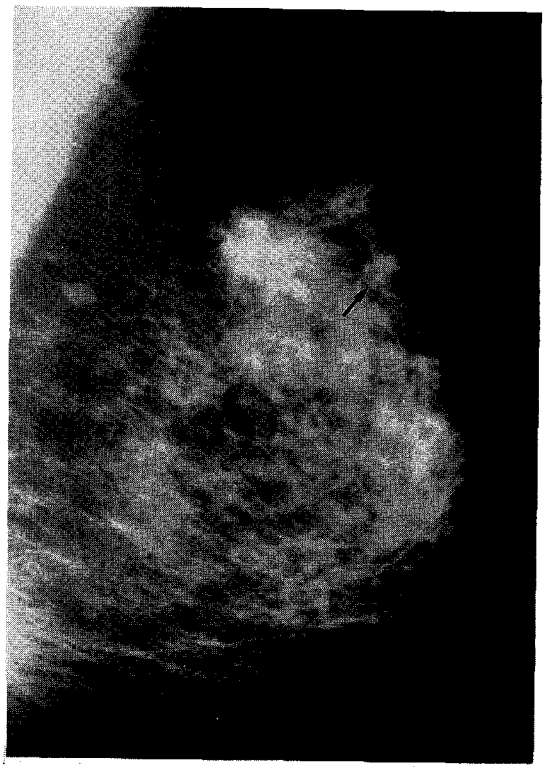

Fig. 1. Screening mammography of the right breast reveals a spiculated mass(large arrow) located in the upper outer quadrant. There is another small irregular mass(small arrow).

Patient 2

Through a routine screening mammogram, a 70 year-old woman was found to have a mass suspicious for cancer in the upper outer quadrant of the right breast which was not palpable(Fig. 3). The mammographer considered the lesion to have about a 30% probability for cancer. Once again, prebiopsy SM was performed. In this case, prone lateral imaging of each breast was performed 5min, after the injection

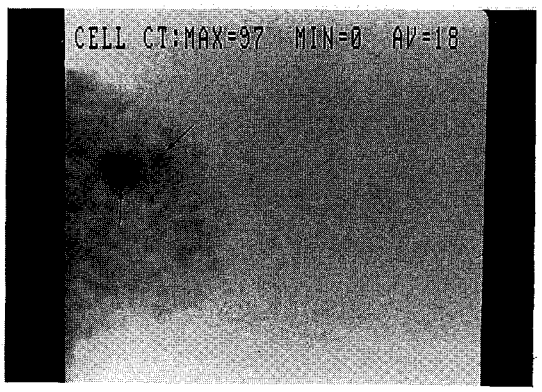

Fig. 2. SM was performed 10min. after injection of 25mCi of 99mTc-MDP. Both breasts were imaged for 10min. Prone lateral SM reveals no focal abnormal increased uptake of MDP within the left breast(not shown). There are two areas of increased MDP uptake in the upper outer quadrant of the right breast corresponding to the mammographic findings(arrows).

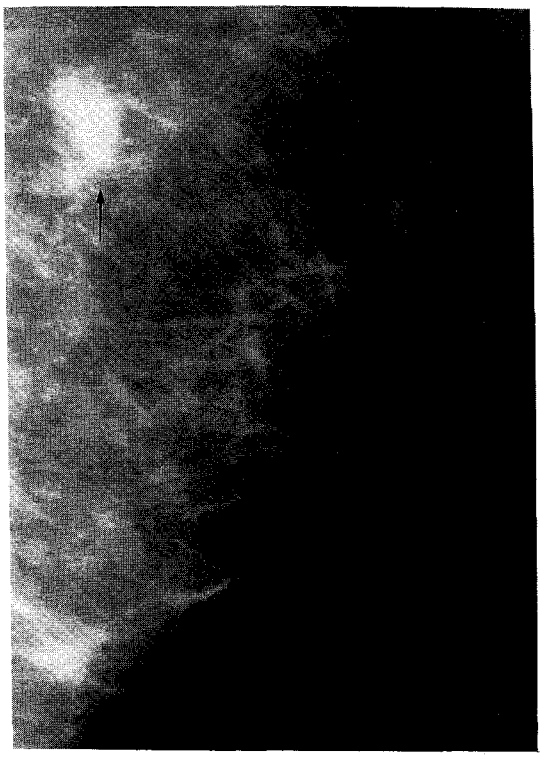

Fig. 3. A routine screening mammography depicts a mass suspicious for cancer in the upper outer quadrant of the right breast(arrow). The mass was not palpable.

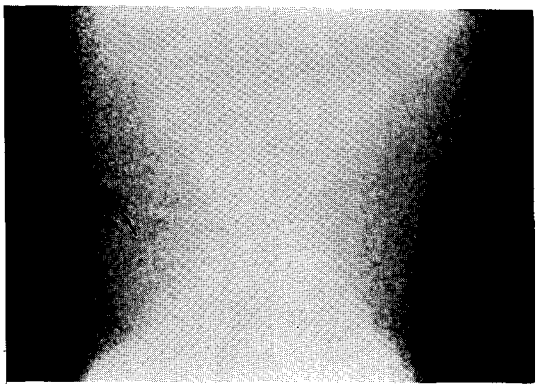

Fig. 4. SM was performed 5min. after injection of 20mCi of ^{99m}Tc-MIBI. Combined prone lateral SM demonstrates an area of increased uptake of MIBI in the upper outer quadrant of the right breast corresponding to the mammographic abnormality(arrow). Note normal left breast.

of 20mCi of ^{99m}Tc-MIBI for 10min. SM of the right breast demonstrated a discrete area of increased MIBI uptake in the upper outer quadrant as seen on CM(Fig. 4). The surgical pathology report described a 6mm nodule with microscopic diagnosis of infiltrating ductal carcinoma.

DISCUSSION

The most effective methods of screening for breast cancer are physical examination and conventional x-ray mammography(CM). Unfortunately, they have a significant false negative rate in detecting breast cancer. In addition to its false-negative rate, CM has a low specificity and positive predictive value[4-7]. Therefore, there is a need for an accurate, noninvasive, cost-effective modality to detect breast cancer in addition to the screening methods.

Scintimammography(SM) has been sporadically and unsuccessfully used for the detection of breast carcinoma since the early 1970s[8-11]. Recently, however, SM has been useful in improving the low positive predictive value(PPV) and negative predictive value(NPV) of CM[12-15]. Three factors responsible for the success of SM include dependent prone lateral imaging, early imaging after the tracer administration and the use of ^{99m}Tc labeled radiopharmaceuticals such as MIBI and MDP. Sensitivity of ^{99m}Tc-MIBI-SM was reported to be 92.2%; specificity, 89.2%; PPV, 81.0%; and NPV, 98.5%.[14] ^{99m}Tc-MDP is inexpensive and SM can be performed as a part of the bone scanning procedure. A recent study of ^{99m}Tc-MDP-SM showed a sensitivity of 92%, specificity of 95% and accuracy of 92%. The PPV and NPV were 98% and 81% respectively[15].

Our two cases reported here demonstrate the ability to detect small breast carcinomas using

^{99m}Tc-MIBI and ^{99m}Tc-MDP. Although SM would benefit all patients, it may prove to be most important for patients with dense breasts where small malignancies may go undetected by mammography. Dense breasts depicted by mammography are more common among Koreans than western population and therefore, SM is expected to play an important role in the management of breast cancer patients in Korea. Along the same lines, scintimammography may also compliment mammography in detecting early carcinomas in young women with dense breasts and a family history of breast carcinoma. Furthermore, the ability to detect small carcinomas with SM may revealed satellite masses within the diseased breast or contralateral breast lesions. In the first case, ^{99m}Tc-MDP-SM was performed while waiting for the bone scan without charge to the patient. The SM revealed two foci of carcinoma, a large mass as well as a smaller less obvious mass. The presence of two lesions within the breast changed the surgical management of this patient from lumpectomy to a mastectomy.

The system resolution of our gamma camera used for SM is about 1cm. However, in our cases, we were able to detect lesions smaller than 1cm. We believe this is due to relatively high levels of tracers which concentrated within the lesions. The ramifications of detecting small breast carcinomas with radionuclides such as ^{99m}Tc-MIBI and ^{99m}Tc-MDP are limitless. SM may lead to significant reductions in the number of unnecessary biopsies performed, thus saving medical costs. Given the cost conscious health care environment, further research and development of SM is essential SM may play a leading role in diagnosing breast carcinoma in the future if SM can detect small malignant lesions. Already SM using a solid state detector and a pinhole collimator are in the works in progress in order to resolve small breast cancers.

In summary, we report small subcentimeter breast carcinomas in 2 cases, one with ^{99m}Tc MDP and the other using ^{99m}Tc MIBI prone lateral scintimammogram.

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