Scintigraphic Isotope Mammography*

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Breast images with ^{99m}Tc-pertechnetate and ^{67}Ga-citrate were obtained in a series of patients under study for breast cancer. These studies were compared with conventional mammography, xeroradiography, and pathologic findings and demonstrated good correlation.

The three principal positions of breast scintigraphy described in the text are the cranio-caudal, lateral, and medial. It is hoped that this technique will prove useful in identifying malignant breast masses.

Breast scintigraphy may be a useful noninvasive imaging test for the detection of breast carcinoma *(1, 2)*. It has aided in the discrimination between benign and malignant lesions. The use of the dual isotopes, ^{99m}Tc-pertechnetate and ^{67}Ga-citrate, seems to be advantageous in these studies *(3)*. This paper describes the techniques of positioning and the methodology for acquiring breast scintigrams.

Methods and Materials

At the National Institutes of Health the routine evaluation of patients with suspected breast cancer includes liver, brain, bone, and ^{67}Ga whole-body scans.

Technetium-99m-pertechnetate ($^{99m}TcO_4^-$) breast scintigraphy is performed 15–60 min after the intravenous injection of 10–15 mCi followed by a routine brain scan. Patients are premedicated with 300 mg of potassium perchlorate. The ^{67}Ga-citrate study is performed 48 hr after the intravenous administration of 50 μCi/kg body weight. Following the whole-body scan, breast scintiphotos are obtained.

Imaging is performed with a Searle HP scintillation camera interfaced to a Hewlett Packard 5407A scintigraphic analyzer. The patients are fitted with a lead apron, cut to expose only the breast in question. No compression devices are used as is common in roentgenographic mammography. Cobalt-57 disk markers are placed on the collimator adjacent to the axillary and nipple regions.

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*This paper was awarded First Prize by the Technologist Section when it was presented in the technologist program at the Society of Nuclear Medicine 21st Annual Meeting in San Diego in June 1974.

FIG. 1. Position for cranio-caudal view. Breast is placed on support under pinhole collimator.

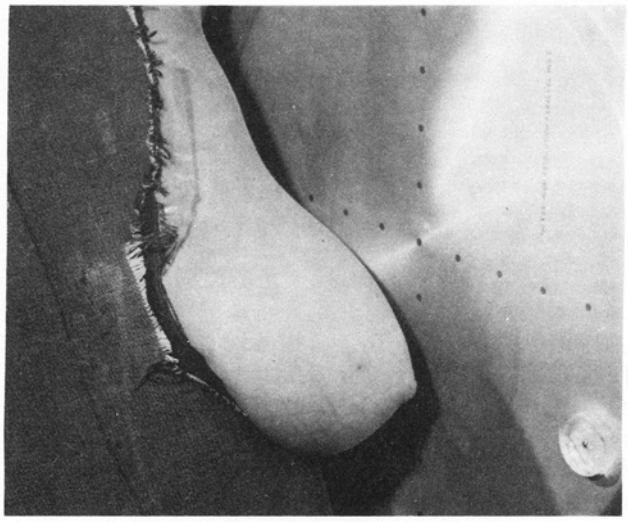

FIG. 2. Lateral position for breast scintigraphy using high-resolution low-energy collimator.

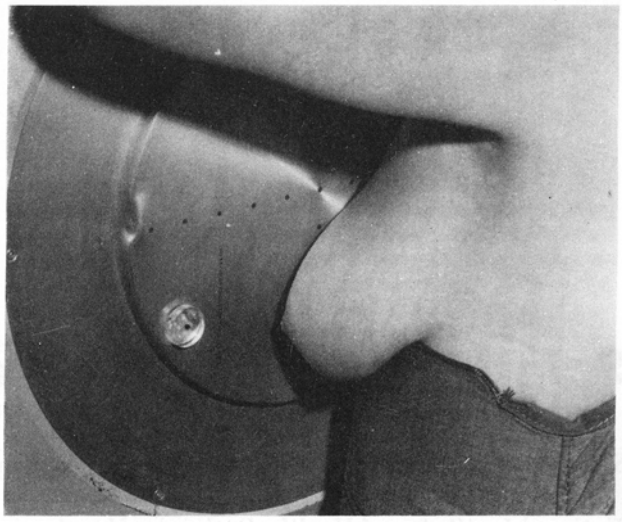

FIG. 3. Medial position at 30-deg oblique angle to surface of collimator.

There are three principal positions in the $^{99m}TcO_4^-$ study, which can be accomplished in 30 min. A pinhole collimator and a 4.5-mm tungsten insert is used for the cranio-caudal view. The lateral and medial views are performed with a high-resolution, low-energy collimator. Attempts to obtain the cranio-caudal view with the high-resolution collimator were suboptimal. The pinhole collimator proved superior, and this point should be stressed because it is necessary to change collimators to complete the examination. In many cases the most diagnostically useful of the three positions in the pertechnetate study was the cranio-caudal view.

Figure 1 demonstrates the proper positioning for the cranio-caudal view. The patient is seated and the exposed breast placed on a stool or table under the camera. The patient's head is turned in the opposite direction to allow the pinhole collimator to be maneuvered as close to the breast as possible. The patient's legs are placed around the stool and covered with the lead apron. The persistence scope is used to insure full coverage of the breast. Imaging is performed acquiring 80,000 counts.

The lateral view (Fig. 2) is accomplished using the high-resolution collimator and a 300,000 count image is obtained. The breast is viewed in profile, separate from the arm and the body.

In the medial view (Fig. 3), the patient is placed in a position with the chest wall at a 30-deg oblique angle to the face of the collimator. The medial aspect of the breast is against the collimator and the arm extended upward and placed over the collimator. Cobalt-57 markers are used on all three views to localize the nipple and axilla. An image containing 300,000 counts is obtained in approximately 200 sec.

In the ^{67}Ga study only the lateral and medial views are obtained using the 1,000-hole high-energy collimator. The cranio-caudal ^{67}Ga view is not

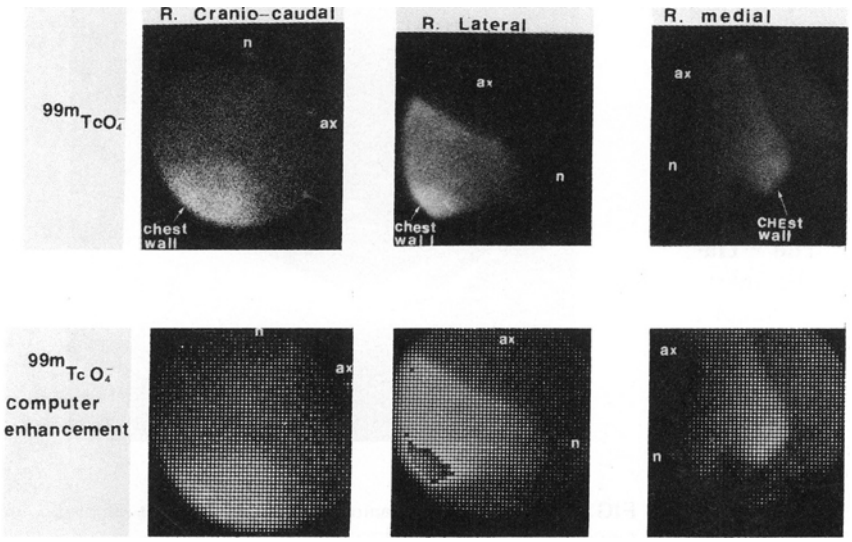

FIG. 4. Normal breast scintigraphy showing three positions with and without computer enhancement.

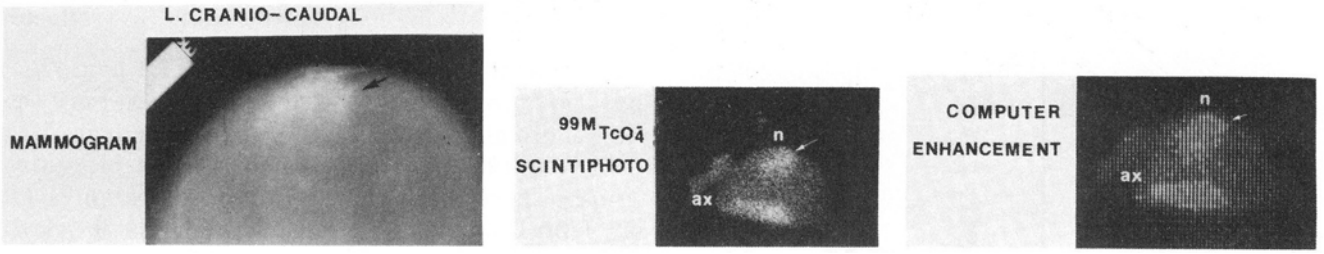

FIG. 5. Cranio-caudal breast views showing mammogram and scintiphoto with and without computer enhancement. Breast tumor is demonstrated behind nipple (arrows). N indicates nipple; ax indicates axillary marker.

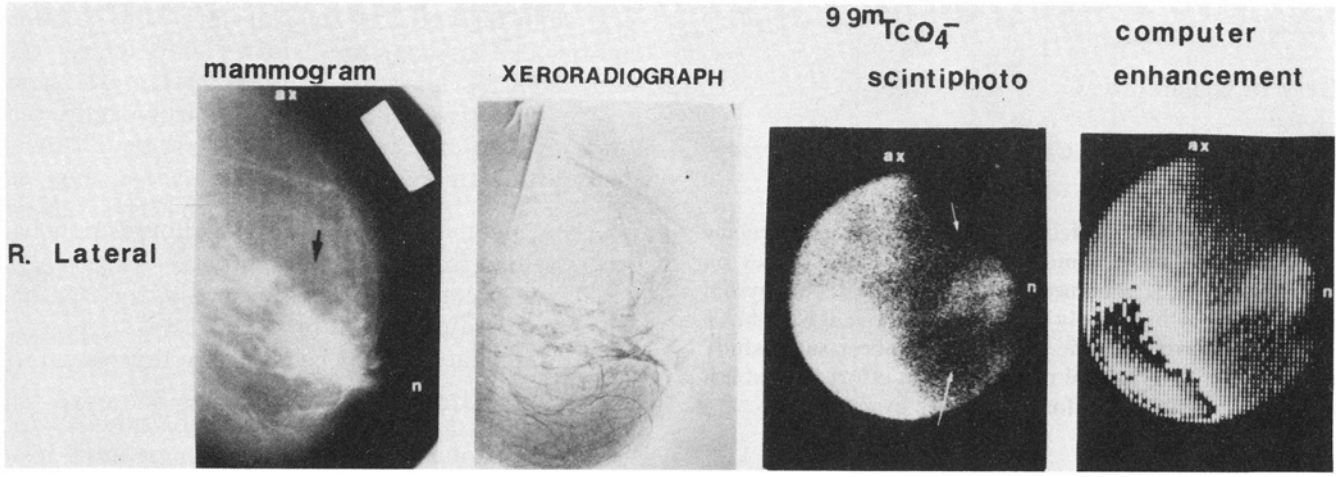

FIG. 6. Lateral breast views of patient with breast carcinoma show lesion on mammogram, xeroradiograph, and scintiphoto.

obtained because of the poor counting rate with the pinhole collimator. The camera is set at the 190-keV energy range with a 25% window and 50,000 counts are collected. Approximate scanning time is 300 sec for each view. Patient positioning is the same as in the pertechnetate study.

Serial dynamic studies following an intravenous bolus of technetium-pertechnetate have proved unrewarding. The high thoracic cage background activity and the small area of interest within the breast are the limiting factors for sequential imaging.

Results

Figure 4 is an example of normal breast scintigraphy. The three positions of ^{99m}Tc-pertechnetate studies are shown at the top. Below is the computer enhancement study confirming homogeneous breast activity in the cranio-caudal, lateral, and medial views. Prominent chest wall activity is noted in all the views. Nipple (n) and axillary (ax) markers are evident.

Figure 5 demonstrates a positive scintiphoto in a 48-year-old woman with a mass in the left breast. The $^{99m}TcO_4^-$ scintiphoto localizes the tumor mass with excellent anatomic correlation when compared with the mammogram. The background subtracted computer image reconfirms the abnormality.

Figure 6 is a lateral projection of a 54-year-old woman with a mass in the right breast. The tumor is visualized on the medio-lateral mammogram and confirmed on the $^{99m}TcO_4^-$ scintiphoto.

Conclusion

In summary, we stress the importance of proper positioning, choice of collimator, and shielding in breast scintigraphy. Breast scintigraphy with $^{99m}TcO_4^-$ and possibly ^{67}Ga may prove useful in the identification of malignant breast masses. This technique is one, however, that can be applied to other isotopes that might localize in breast masses.

Access to a computer is not necessary since Polaroid or 35-mm scintigraphy is quite adequate for diagnostic purposes. Broader experience with investigation of this technique will help to establish its effectiveness.

References

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