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Scintimammography screening for recurrent breast cancer in women

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Summary
Scintimammography(SM) is a nuclear medicine technique in which a tumour seeking radionuclide is used to localize or trace an active or residual tumour in breast tissue. It involves the injection of a radiopharmaceutical into circulation and obtaining a scan of the breast tissue10-15min later. This procedure has been shown to be an accurate diagnostic tool in patients with symptomatic breast lesion with a non-diagnostic mammogram and for whom characterizing the lesion becomes important. This retrospective study was done using the case records of all 72 patients who had presented for scintimammography on follow -up for breast conservation surgery from January to August 2005. The result of scintimammography done using ^{99m}Tc tetrofosmin method was compared with mammograms and cytology reports when available. A total number of 52 patients, mean age 49.4 ± 8.71years (range35-67) were analyzed. The commonest presentation was induration at site of surgery. In 43 patients without recurrent disease, scintimammography correctly characterized 42 while 8 out of the 10 patients with recurrent disease confirmed by histology reports were correctly identified The sensitivity of this study was 88.8%, while specificity was 95.4%. The positive predictive value was 80%, while the negative predictive value was 95.3%. Given the non-invasiveness of scintimammography and the high diagnostic index, it is a very useful tool in breast cancer diagnosis and follow-up. Furthermore, the radiation dose to the patient is lower than a chest radiograph and as such the fear of radiation comparatively is milder.

Keywords: *Scintimammography, screening, breast cancer, follow- up recurrence*

Résumé
La scintimammographie est une technique en médecine nucléaire qui utilise les substances radioactive pour localiser ou repérer les résidus des tissues des tumeurs des mammelles. Ceci tient à injecter une substance radio pharmaceutique dans la circulation sanguine et le scanner du tissue obtenu entre 10-15 min. Cette procédure a démontré une précison comme outil du diagnostic chez les patients symptomatiques des lésions des mamelles avec un mammogramme non spécifique nécessitant une caractérisation de la lésion. Cette étude rétrospective était fait utilisant les registres de 72 patients qui se suivaient une scintimammographie après une chirurgie des mammelles de janvier à Août 2005. Le résultat de la scintimammographie était faite utilisant la méthode de 99mTc tetrofosmine comparé avec les mammogrammes et les résultats cytologiques disponible. Au total 52 patients avec une moyenne d'age de 49.4 +_ 8.71 ans (35-67 ans) étaient analysés. La présentation la plus commune sur ce site était la chirurgie. Chez 43 patients sans réccurence de la maladie, la scintimammographie était correctement caractérisée chez 42 alors que 8 sur les 10 patients ayant eu une récurrence confirmaient les résultats histologiques. La sensitivité de cette étude était de 88.8% et la spécificité de 95.4%. La valeur de prédiction positive était de 80% et celle de prédiction négative de 95.3%.Compte tenu de la nature non invasive de la scintimammographie et de l'indexe de diagnostic élevé, cet instrument est utile dans le diagnostic du cancer des seins et la suivi. En plus la dose de radiation chez le patient est plus faible que la radiographie de la poitrine et la peur de la radiation réduite.

Introduction

The follow –up of patients with cancer and the best modality for it in view of the huge cost involved as well as and the quality of life of patients has been of keen interest to Oncologists worldwide. In breast cancer, it is known that physical examination and conventional imaging modalities have their limitations in the detection of recurrent disease especially following breast conservation surgery. Surgical intervention and external beam radiotherapy can cause architectural distortions and increase breast density post- treatment making the interpretation of

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mammography less accurate. Scintimammography(SM) is a nuclear medicine technique in which a tumour seeking radionuclide is used to localize or trace an active or residual tumour in breast tissue. It involves the injection of a radiopharmaceutical intravenously and obtaining a scan of the breast in the prone position 10-15min later. This procedure has been shown to be an accurate diagnostic tool in patients with symptomatic breast lesion with a non-diagnostic mammogram and for whom characterizing the lesion becomes important [1].

Scintimammography can be carried using any of these agents 99mTc sestamibi, 99mTc tetrofosmin, 99mTc methylene diphosphonate (MDP) and 99mTc methoxyisobutyl isonitrite (MIBI) [1,2,3,4] and more [5]. Workers have found the sensitivity and specificity for this modality in the range of 83-95% and 71-91% respectively [1-10]. The general advantage of nuclear medicine imaging is that tumour-seeking radio pharmaceuticals accumulate in viable cancer lesions, which makes scintimammography and Positron Emission Tomography (PET) fundamentally different from the radiological techniques that image the tumour mainly on the basis of morphological alterations. Scintimammography is indicated for the study of breast lesions in patients in whom mammography is non-diagnostic or difficult to interpret; it may be useful also to assess and even predict the response to primary chemotherapy [9]. Scintimammography can also be used to distinguish between benign and malignant breast diseases [1] and as such a very useful diagnostic tool. Diagnosis of breast cancer recurrence in patients that have had modified radical mastectomy is better visualized by MRI and spect scintimammography. Comment can however be made on the contra lateral breast in such patients. When planar images are combined with that of tomography (SPECT), the sensitivity of SPECT results in significantly higher images which helps particularly in the detection of smaller lesions [11]. This issue is of the utmost importance: the ability to visualize small breast cancers

This retrospective analysis of patients on follow-up for breast cancer was carried out at Rajiv Gandhi Cancer Institute New Delhi, India during a 3-month IAEA fellowship training in Nuclear Medicine in that institute. The aim was to highlight the role of 99m Tc tetrofosmin scintimammography in the follow –up of patients with breast cancer and to sensitize Clinicians and Oncologists to the availability of Nuclear Medicine facility at the University College Hospital Ibadan.

Materials and method

The case records of all 72 patients who had presented for follow up following breast conservation surgery chemotherapy and or radiotherapy for scintimammography from January to August 2005 were selected for this study. The indications for the study varied from pain, to induration, lump, skin changes at the site of the residual breast tissue to no symptom.

Scintimammograms, mammograms and cytology reports when available were analyzed. Scintimammography was done using ^{99m}Tc tetrofosmin method. Each patient received 740MBq (20 mCi) 99Tcm-tetrosfosmin intravenously in either foot or the contralateral arm when a vein cannot be seen on the feet. Static images of both breasts were acquired prone using a dual head (multispect) camera and a low energy all purpose collimator in anterior, lateral and oblique views 15-20minutes after the injection with the help of customized breast overlay. The axilla was included in the field of view. A scan was taken as possibly malignant if the increased tracer uptake in the initial scan reading persisted in the delayed image acquired 2 hours later. All the scans were read by the attending nuclear medicine Consultant of the hospital.

Three patients were excluded because the indication for their scintimammographies was for restaging of their disease. Scintimammogram findings were correlated with cytology reports and clinical findings to determine the sensitivity and specificity of the modality. Only patients with a minimum of 3 months disease free period post treatment of breast cancer were used for analysis.

Results

A total number of 53 patients, mean age 49.4 ± 8.71 years (range35-67) were analyzed. The clinical findings of these patients at follow –up varied from pain, induration, lump, skin changes to no symptom. The commonest presentation was induration at site of surgery. Table 1 shows the profile of scintimammography compared to histology.

Table1: Result of the screening by SM compared to histology

	Histology Positive	Histology Negative	Total
Scintimammography Positive (+)	8	2	10
Scintimammography Negative (-)	1	42	43
Total	9	44	53

In 43 patients without recurrent disease, scintimammography correctly characterized 42 while 8 out of the 10 patients with recurrent disease confirmed by histology reports were correctly identified .The sensitivity of this study was 88.8%, while specificity was 95.4%. The positive predictive value was 80% while the negative predictive value was 95.3%.

Discussion

Cancer of the breast is the 2nd most common malignancy in women in Nigeria [12]. One hundred and forty four (144) new cases are seen every year in the University College Hospital, Ibadan Nigeria (Personal communication with a Senior Oncologist). Presently, the modality of follow –up is largely clinical examination, mammography, and chest radiography when indicated. With a Department of Nuclear Medicine and the facility of a gamma camera, scintimammography will also become one of the modality of management and follow-up in these patients. This is of further relevance since scintimammography interpretation is independent of breast tissue density.

This study had a sensitivity of 88.8% but a higher specificity of 95%.Compared with a meta analysis of 5340 patients by Liberman *et al* [13] in 2003, a sensitivity of 85.2 %and a specificity of 86.6% was obtained for patients with a palpable mass This may be so because the patients studied were largely on follow up, either having had lumpectomy, modified radical mastectomy followed by chemotherapy and or radiotherapy.

The same reason will also account for the apparently low positive predictive value (PPV) and a higher negative predictive value (NPV). These findings are however much higher than the observation for plain mammography with sensitivity and specificity of 81%and 82.4% respectively [1]. Many studies have shown the lack of specificity for mammography. Specificity is in the 15-25% range. This means that approximately 20 out of 100patients who will have normal mammography may also have cancer. The overall sensitivity varies depending on population selection but it is approximately 70-90% [7]. The same report had a PPV 85% and NPV of 77.8% .The limitation of mammography lies in dense breast parenchyma, implants,severe dysplastic disease or previous surgery or radiotherapy [8,13]. Khalkhali *et al* [10] performed scintimammography in a group of 59 patients, in whom an abnormal mammogram and physical examination warranted biopsy or fine-needle cytology of the breast.

They reported a sensitivity of 95.8%, specificity of 86.8%, positive predictive value of 82.1%, and negative predictive value 97.1%. On the basis of these results, the authors concluded that scintimammography is very sensitive and able to improve the specificity of mammography so potentially useful to reduce the high rates of negative biopsies performed. Given the non-invasiveness of scintimammography and the high diagnostic index, it is a very useful tool in breast cancer diagnosis and follow-up. Furthermore, the radiation dose to the patient is lower than a chest radiograph and as such the fear of radiation comparatively is milder.

Conclusion

With the advent of Nuclear medicine (in-vivo) techniques at the University College Hospital Ibadan, Nigeria and the subsequent availability of scintimammography, ^{99m}Tc tetrofosmin scintimammography would be a veritable tool in diagnosis and follow-up of breast cancer patients.

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References

1. Fenlon H.M., Phelan N.,Tiemey S., *et al.* ^{99m} Tc tetrofosmin scintigraphy as an adjunct to plain film mammography in palpable breast lesions. Clin. Radiol. 1998; 53(1): 17-24.
2. Ruth L Polan, Barry D.Klein and Roselyn H. Richman. Scintimammography with minimal mammographic or clinical findings. Radiograhics 2001; 21: 641-655.
3. Taillefer R.The role of 99m Tc sestamibi and other conventional radiopharmaceuticals in breast cancer diagnosis. Semin Nucl Med.1999 Jan;29(1): 16-40.

4. Shao Liang Chen ,Ivenguan Liu, Ying Mao *et al.* Comparism between 99mTc methoxyisobutyl isonitrite and methylene diphosphonate scintimammography for detection of breast carcinoma. Medical Principles and Practice 2001;10:6-10
5. Papantoniou V, Christodoulidou J, Papadaki E, Valotassiou V, *et al.* 99mTc-(V) DMSA scintimammography in the assessment of breast lesions: comparative study with 99mTc-MIBI. Eur J.Nucl Med. 2001 Jul;28(7) 923-928.
6. Bongers V, Perre C and de Hooge P. The use of scintimammography for detecting the recurrence of locoregional breast cancer in histopathologically proven results. Nucl. Med. Commun.2004 ;(2): 145-149.
7. Prats E, Banzo J, Merono E., *et al.* ^{99m}Tc MIBI scintimammography as a complement of the mammography in patients with suspected breast cancer. A multicentre experience. Breast 2001; 10(2):109-116.
8. Yang M.D., Sun S.S., Kao C.H *et al.* Usefulness of Technetium-^{99m}Tetrofosmin scintimammography to detect breast cancer in mammographically dense breast. Cancer Invest.2002; 20(4): 518-523.
9. Bombardieri E., Crippa F, Baio S.M.*et al*, Nuclear medicine advances in breast cancer. Imaging Tumori. 2000; 87(5): 277-287.
10. Khalikhali I, Mena I, Jouanne E, *et al.* ^{99m} Tc-sestamibi Prone breast imaging in patients with suspicion of carcinoma of the breast. J. Am. Coll. Surg. 1994; 178:491-497
11. Mathieu I, Mazy S, Willemart B, Destine M, Mazy G, Lonneux M. Inconclusive triple diagnosis in breast cancer imaging: Is there a place for scintimammography? J Nucl Med. 2005; 46: 1574–1581.
12. Ogunbiyi J.O. Epidemiology of Cancer in Ibadan: tumours in Adults. Archives of Ibadan Medicine 2000; 1 (2): 9-12
13. Liberman M, Sampalis F, Mulder DS and sampalis J.S. Breast cancer diagnosis by scintimammography: a meta analysis and review of lite rature. Breast Cancer Res. Treat.2003 Jul; 80 (1): 115-126.

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