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Patient Acceptance of Half-dose Vs. Half-time Molecular Breast Imaging

Tiffinee N. Swanson, CNMT[a*], Thuy D. Tran, CNMT[a], Carrie B. Hruska, PhD[a], Courtney M. Solberg, CNMT[a], Deborah J. Rhodes, MD[b], Katie N. Hunt, MD[a], Amy Lynn Conners, MD[a] and Michael K. O'Connor, PhD[a]

[a] *Department of Radiology, Mayo Clinic, Rochester, Minnesota, USA*
[b] *Department of Internal Medicine, Mayo Clinic, Rochester, Minnesota, USA*

ABSTRACT

Objective: A number of strategies have been implemented at our institution to allow reductions in the administered dose or imaging time for molecular breast imaging (MBI). In this work, we examine patient opinions of whether dose reduction or time reduction is preferred.

Methods: Sixty female volunteers were randomized to undergo MBI at either half-dose (150 MBq Tc-99m sestamibi; images acquired for 10 minutes per view) or half-time (300 MBq Tc-99m sestamibi; images acquired for 5 minutes per view). A survey was then performed to assess patient comfort and examination preferences. Survey responses were compared between groups using Fisher's exact test.

Results: No differences were observed between groups regarding opinions of radiation dose, duration of examination, examination comfort, and willingness to undergo MBI in the future. Of those who responded, most women (39/55 [70%]) indicated a preference for the examination type they underwent, either half-dose or half-time MBI, rather than the other protocol.

Conclusions: Survey findings support that MBI, whether performed at half-time or half-dose, is well accepted by patients.

Keywords: Tc-99m sestamibi; molecular breast imaging; survey; dose

RÉSUMÉ

Objectif : Un certain nombre de stratégies a été mis en place dans notre établissement afin de permettre la réduction de la dose administrée ou du temps d'imagerie pour l'imagerie moléculaire du sein (IMS). Dans cet article, nous examinons l'opinion des patientes pour savoir si elles préfèrent une réduction de la dose ou du temps d'imagerie.

Méthodologie : 60 patientes volontaires ont été sélectionnées au hasard pour recevoir une IMS à demi-dose (150 MBq Tc-99m sestamibi; acquisition d'image à 10 min. par vue) ou à durée réduite (300 MBq Tc-99m sestamibi; acquisition d'image à 5 min. par vue). Un sondage a ensuite été effectué afin d'évaluer le confort des patientes et les préférences face à l'examen. Les réponses des deux groupes ont été comparées selon la méthode exacte de Fisher.

Résultats : Aucune différence n'a été observée entre les deux groupes en ce qui a trait aux opinions sur la dose de rayonnement, la durée de l'examen, le confort de l'examen et l'empressement à passer un examen d'IMS dans le futur. Parmi celles qui ont répondu, la plupart des patientes (39/55 [70%]) ont indiqué une préférence pour l'examen qu'elles avaient eu, que ce soit la demi-dose ou l'IMS en demi-temps, plutôt que l'autre protocole.

Conclusion : Les résultats du sondage montrent que l'IMS, à demi-dose ou à demi-durée, est bien acceptée par les patientes.

Introduction

Mammographically dense breast tissue is a common feature affecting more than 50% of the screening eligible population of the United States. Breast density limits the sensitivity of mammography, as both fibroglandular dense tissue and cancerous lesions appear radiopaque, or white, on the image. Not only has breast density been associated with the potential to mask cancers, but it has also been identified as an independent risk factor for developing breast cancer, associated with a

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* Corresponding author: Tiffinee N. Swanson, CNMT, Department of Radiology, Mayo Clinic, 200 First Street SW, Gonda 2_130BII, Rochester, MN 55905.
E-mail address: swanson.tiffinee@mayo.edu (T.N. Swanson).

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greater risk than having a first-degree relative such as a mother or sister with breast cancer [1]. Breast density notification legislation, passed in 32 US states, informs women of these potential risks but there is yet no national consensus on which modality, if any, should be offered for supplemental screening of women with dense breasts [2].

One supplemental screening modality, molecular breast imaging (MBI), is a nuclear medicine technique using dedicated gamma cameras optimized for breast imaging to image uptake of Tc-99m sestamibi in breast lesions. Although the exact mechanism of uptake is unknown, it is hypothesized that Tc-99m sestamibi in breast tumors is relative to mitochondrial metabolism and/or the high negative membrane potential of tumor cells. Because this physiological uptake is not impacted by breast density, MBI has shown utility in detecting cancers occult on mammography because of dense breast tissue, increasing sensitivity from 25% with mammography alone to 91% with the combination of mammography plus MBI [3]. Figure 1 illustrates the ability of MBI to aid in the detection of mammographically occult lesions because of breast density. Despite the increased cancer detection, concerns about radiation risks and long imaging time have been raised as potential barriers to the acceptance of MBI for routine screening [4, 5].

Our institution performs MBI with a prescribed activity of 300 MBq (8 mCi) Tc-99m sestamibi and an imaging time of 10 minutes per view [6-8]. Although this activity gives an effective dose of 2.1 mSv [9, 10], which is less than annual background levels and considered safe for routine use, additional options for dose reductions continue to be explored [11]. By using syringes that minimize the amount of sestamibi lost during injection from adhesion to syringe walls [12] and administering sestamibi while the patient is fasting, resting, and warmed, breast uptake can be increased by an additional 50% [13], making further reductions in prescribed activity possible.

Instead of applying these advances to pursue further dose reduction for MBI, another option would be to reduce acquisition time. This option may improve patient comfort and reduce the likelihood of patient motion during acquisition, which can be a significant cause of image degradation in MBI, reducing the ability to detect small lesions [14]. Reduced acquisition time would also have important workflow and financial implications for radiology departments. However, patient opinion must be considered. A shorter examination time may increase a patient's willingness to undergo the examination, while some may prefer a lower radiation dose over reduced examination time.

To better understand the impact of these options from a patient standpoint, we recruited volunteers to undergo MBI performed with either a half-dose or half-time protocol and conducted a post-test survey. The objective was to compare opinions of patients undergoing MBI performed with reduced dose or reduced time.

Methods

This study was performed under an institutional review board–approved, HIPAA-compliant research protocol and written informed consent was obtained. Participants were required to be age $\geq$40 years, have no current breast concerns, and have had mammography performed within the last 15 months that showed negative or benign findings and heterogeneously or extremely dense breast tissue [15]. Women who were pregnant, lactating, or unable to fast for 4 hours were not eligible.

Participants were randomized into two groups. The first group underwent MBI with 150 MBq Tc-99m sestamibi (half the usual prescribed dose) and images were acquired for 10 minutes per view (half-dose group). The second group had MBI performed with 300 MBq Tc-99m sestamibi and images were acquired for 5 minutes per view (half-time group). Activity was administered by intravenous injection, and residual syringe activity was measured post-injection. The time of injection and measurement of initial activity were recorded to permit correction for decay of the Tc-99m and computation of administered activities. Two to five minutes post-injection, bilateral craniocaudal and mediolateral oblique analogous views of each breast were acquired under light compression. During the examination, participants were given the option to watch a video to help pass the time.

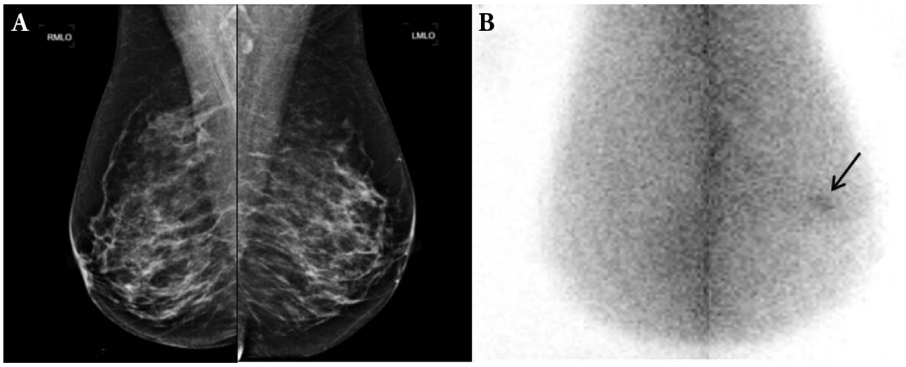

Figure 1. Mammographically occult cancer detected on MBI in 51-year-old woman presenting for screening. Screening mammogram (right and left MLO views, panel A) was interpreted as negative with heterogeneously dense parenchyma. Supplemental screening MBI (right and left MLO views, panel B) performed same day using a half-dose (150 MBq) protocol detected a 18 × 13 × 13 mm area of focal uptake (arrow) in the upper outer left breast. Biopsy of this lesion showed invasive ductal carcinoma, Nottingham grade II. MBI, molecular breast imaging; MLO, mediolateral oblique.