

BREAST LESIONS DETECTED VIA MOLECULAR BREAST IMAGING: PHYSIOLOGICAL PARAMETERS AFFECTING INTERPRETATION

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Background

Molecular Breast Imaging (MBI) is increasingly being used as an adjunct imaging modality in the detection of breast cancer. ¹ A meta-analysis in 2013 from 8 studies, including 2183 lesions, showed that the sensitivity and specificity of MBI were 95% and 80%, respectively. ² Patients received an intravenous injection of Tc-99m-sestamibi, and a gamma camera was used to obtain Craniocaudal (CC) and mediolateral oblique (MLO) projections.

Methods

A retrospective review was performed on 193 suspicious findings from 153 women (31-81 years) with positive MBI examinations. We assessed associations between:

- (i) Lesion pattern (mass vs. non-mass) and positive predictive value (PPV)
- (ii) Lesion pattern and suspected likelihood of cancer (low vs. moderate vs. high)
- (iii) Background parenchymal uptake (BPU) (homogeneous vs. heterogeneous) and PPV
- (iv) Breast density (dense vs. non-dense) and PPV
- (v) BPU and density

Table 1 - Pathology of Malignant and High-risk Lesions Detected Using MBI

Malignant Types	# of Lesions	# of Mass	# of Non-Mass
Ductal carcinoma in situ	35	18	17
Invasive ductal carcinoma	24	21	3
Invasive ductal carcinoma with a component of ductal carcinoma in situ	44	31	13
Invasive lobular carcinoma	8	4	4
Total	111	74	37

High-risk Types	# of Lesions	# of Mass	# of Non-Mass
Atypical ductal hyperplasia	6	4	2
Atypical lobular hyperplasia	5	3	2
Lobular carcinoma in situ	3	0	3
Papillomatosis	3	0	3
Radial Scar	2	0	2
Total	19	7	12

Images

Figure 1A

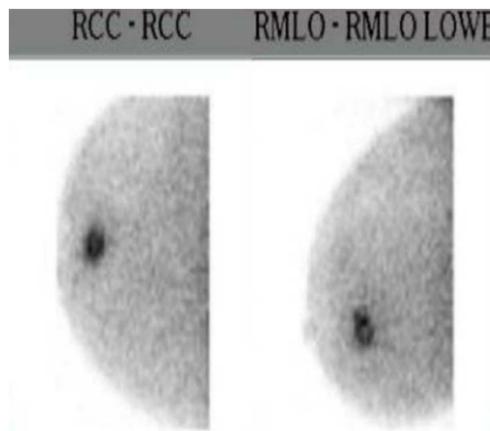


Figure 1B

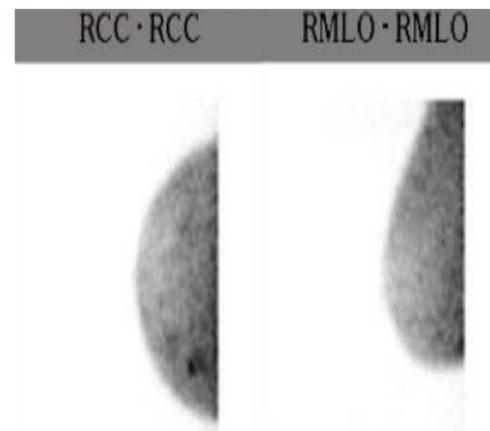


Figure 1C

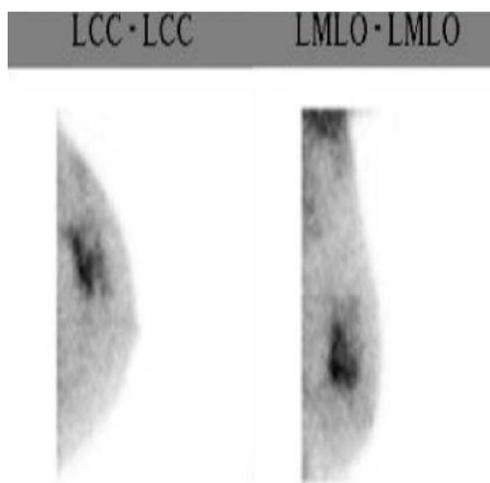


Figure 1D

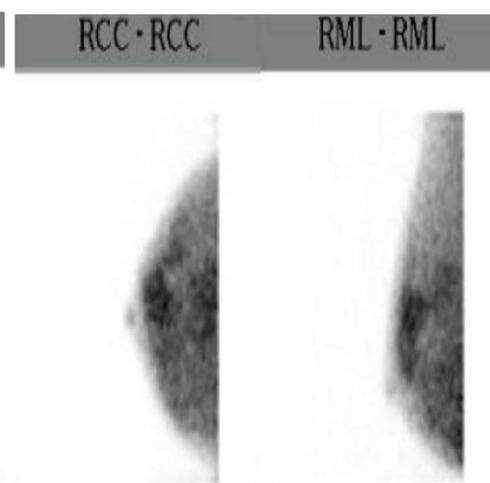


Figure 1A – 80-year-old woman with a mass lesion on homogeneous BPU, diagnosed as ductal carcinoma in situ in the right breast.

Figure 1B – 53-year-old woman with a mass lesion on heterogeneous BPU, diagnosed as invasive ductal carcinoma on the right breast.

Figure 1C – 68-year-old woman with a non-mass lesion on homogeneous BPU, diagnosed with invasive ductal carcinoma with a component of ductal carcinoma in situ on the left breast.

Figure 1D – 48-year-old woman with a non-mass lesion on heterogeneous BPU, diagnosed as invasive ductal carcinoma with a component of ductal carcinoma in situ on the right breast.

Results

110/153 patients were diagnosed with malignant or high-risk pathology (PPV₁ = 71.9%), and 130/193 biopsies resulted in malignant or high-risk lesions (PPV₃ = 67.4%).

- (i) Biopsies of mass vs. non-mass findings had comparable PPV₃ (71.7% vs. 61.3%; P = 0.0717).
- (ii) Mass findings were correlated with higher suspicion for cancer than non-mass findings (P < 0.001).
- (iii) There was no significant difference in PPV₃ between biopsies from homo vs. hetero BPU (72.5% vs. 60.7%; P = 0.103). No association was found between BPU and the diagnosis of cancer or high-risk pathology (P = 0.513).
- (iv) Biopsies from non-dense breasts had higher PPV₃ than from dense breasts (85.4% vs 60.6%; P = 0.0025); patients with non-dense breasts were more likely to yield cancer or high-risk pathology (PPV₁ = 87.8% vs. 66.0%; P = 0.00844).
- (v) Dense breasts had greater association with heterogeneous BPU (P = 0.0844) than non-dense breasts.

Conclusion

Understanding PPV of MBI in correlation to the character of lesions, BPU, and breast density provides a useful framework for interpretation and risk-stratification. Our study demonstrated that variability in mass or non-mass character of positive MBI findings may affect clinical suspicion but was not a useful determinant for probability of malignancy. Additionally, homogeneous vs. heterogeneous BPU did not significantly affect predictability of positive MBI images. Lastly, dense breasts yielded more false positives, likely due to the association with heterogeneous BPU.

References

- Conners A, Hruska C, Berg W, et al. Lexicon for standardized interpretation of gamma camera molecular breast imaging: observer agreement and diagnostic accuracy. *European Journal of Nuclear Medicine and Molecular Imaging*. June 2012;39(6):971-982.
- Sun Y, Wei W, Yang HW, Liu JL. Clinical usefulness of breast-specific gamma imaging as an adjunct modality to mammography for diagnosis of breast cancer: a systemic review and meta-analysis. *European Journal of Nuclear Medicine and Molecular Imaging*. 2013;40(3):450-63.