



Can Contrast-Enhanced Spectral Mammography (CESM) Reduce the Number of Unnecessary Breast Biopsies? Analysis of 593 Cases of Patients with Suspected Breast Cancer

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Introduction

Breast cancer is the most frequently diagnosed malignancy, with a frequency of 22.8% of all new cancer incidence rates in Poland. Contrast-Enhanced Spectral Mammography (CESM) is a relatively new method used in breast cancer diagnosis, which involves the phenomenon of neoangiogenesis of cancerous tumours, allowing contrast enhancement in the areas of vessel proliferation in the background of the surrounding breast tissue. In recent years, the number of mammography centers using CESM on a daily basis has increased. Typically, CESM is used to evaluate patients with suspected focal lesions in whom conventional Mammography (MG) and additional Ultrasound examinations (US) do not allow a definitive diagnosis. CESM is particularly useful in the diagnosis of dense breasts (ACR categories C, D), where cancer detection is difficult due to the lower sensitivity of conventional mammography.

Our study aimed to assess whether it is possible to reduce the number of unnecessarily performed breast Core Needle Biopsies (CNB) in case of lesions that did not undergo post-contrast enhancement while using Contrast-Enhanced Spectral Mammography (CESM). An additional aim of the study was to calculate the potential financial savings from performing a CESM instead of a biopsy.

Description

Patients and methods

547 patients with 593 breast lesions detected in ultrasonography and classic mammography were enrolled in the retrospective study.

All patients before the biopsy underwent CESM examination. The CESM results have been compared with the gold standard in the diagnosis of breast cancer, which is histopathological examination. Sensitivity, specificity, negative and positive predictive values of CESM in detecting breast cancer was calculated. Changes that were not enhanced after intravenous contrast administration in CESM subtraction images were classified as ones for which CNB could be omitted.

Then the possible financial profit resulting from the withdrawal from CNB and CESM implementation was calculated. For the study, the average cost of one CNB and one CESM was set at 170 euros and 65 euros (conversion from PLN to EUR).

CESM examination

All CESM examinations were carried out with a digital mammography device dedicated to performing dual-energy CESM acquisitions (SenoBright, GE Healthcare, 3000 N. Grandview Blvd., Waukesha, WI, USA).

An intravenous injection of 1.5 mL/kg of body mass of a non-ionic contrast agent was performed. The exposure pair (low and high energy) was performed automatically. Specific image processing of low-energy and high-energy images was done to obtain subtraction images to highlight contrast enhancement and suppress structured noise due to fibroglandular breast tissue.

Rhodium anode material was used for all acquisitions, with molybdenum and rhodium filters with kVp ranging from 26 to 32 used for low energy acquisitions. The total duration of the examination was usually around 10 min.

The analysis includes 593 breast lesions diagnosed in 547 women. In the studied group cancer was detected in 327 (55.14%) lesions and in 256 (43.17%) cases benign lesions were confirmed by histopathological examination and at least 12 months of observation.

In 428 (72.2%) lesions changes of increased vascularization were detected, while in the remaining 165 (27.8%) lesions the CESM result was negative. Taking the CESM enhanced result as the criterion of malignancy, the method shows differentiation of benign and malignant lesions in the breast: sensitivity of 97.86%, specificity of 59.4%; PPV 74.76%; NPV 95.76% (Table 1).

		Histopathology result		
		Malignant	Benign	
Contrast	Enhanced	320	108	PPV: 74.76%

Enhancement	Non-enhanced	7	158	NPV: 95.76%
		Sensitivity: 97.86%	Specificity: 59.4%	

Table 1: Comparison of lesions clinical characteristics and the results of the spectral mammography analysis.

The 165 changes did not present post-contrast enhancement in histopathological examination and only 7 as malignant (4.24%). Table 2 presents the individual histopathological diagnoses of changes that were not enhanced with post-contrast enhancement.

Lesion	Quantity (% of all non-enhanced lesions)
Fibrotic sclerosis	124/165 (75.15%)
Fibroadenoma	18/165 (10.9%)
NST	2/165 (1.2%)
DCIS	5/165 (3.03%)
Papilloma	1/165 (0.61%)
LCIS	6/165 (3.6%)
Other	9/165 (5.45%)
NST-non-specific type cancer	
Note: DCIS-pre-invasive ductal carcinoma, LCIS-Lobular Carcinoma <i>in situ</i> , Other-focal apocrine metaplasia, atheroma, usual ductal hyperplasia, microglandular hyperplasia, cyst, phyllodes tumour	

Table 2: Individual non-enhanced lesions depending on the histopathological results.

The estimated cost of 165 core needle biopsies was 28 050 euros and CESM was only 10 725 euros. By performing only CESM without CNB the potential financial savings would be 17,325 euros (61.76%) (Figure 1).

- CEM is an emerging modality that may provide critical information in a number of clinical scenarios. Today, CEM is most commonly used to evaluate disease extent in patients with contraindications to MRI. It is also increasingly being used in the diagnostic setting for patients recalled from screening. However, as the interest in CEM grows, additional studies are needed to further understand the role of CEM in breast imaging.
- Thus, unnecessary biopsies can be avoided and cost of diagnostics in breast cancer patients reduced.

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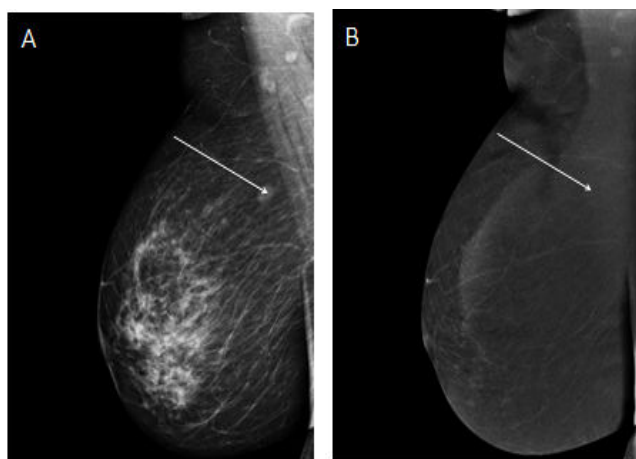


Figure 1: A) The low-energy MLO image shows a visible lesion assessed as BI-RADS 4 by classical mammography. A focal lesion biopsy was performed and a histopathological examination revealed benign fibroadenoma; B) Subtraction MLO image shows no enhancement after intravenous contrast administration.

Conclusions

- The lack of post-contrast enhancement in CESM is a good indicator of benign character.