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Benefits of Contrast-enhance Mammography for Supplemental Screenings

MARC LOBBES

MD, PhD, Chairperson of the Board, Department of Medical Imaging at Zuyderland

With the European Council's revision of breast screening recommendations last year, radiology departments are facing a new era for mammography. With the addition of digital breast tomosynthesis (DBT), also known as 3D mammography, to the radiology toolkit, this opens the way to new advancements in patient health.

One of these advancements, contrasted-enhanced mammography (CEM), has seen several important technical improvements since it first came to market in 2011. CEM technology can help identify lesions in breast tissue by utilizing the same contrast agent as computed tomography (CT) technology. Following the application of the contrast agent, it moves throughout the breast tissue via blood flow and accumulates where lesions are forming and growing. The result is a highlighted area that stands out against the breast tissue that could provide additional physiological data for diagnosis.

In my experience, since the first generation of CEM systems used existing mammography units that were refitted with additional hardware and software, I observed that they were plagued with issues from CEM-specific artifacts, such as the 'breast-in-breast' artifact, skin line enhancement and ripple artifacts caused by slight motion during the acquisition. Additionally, those retrofitted mammography units could not be utilized for imaging in the multiple days required to upgrade the system.

Today, CEM systems are not retrofit, which resolves the issues seen on previous generations. As image quality has continued to improve, this has helped increase the popularity of the technology among radiologists. As this technology continues to improve, it provides many benefits for hospitals and clinics as a means to help improve workflow, decrease demand for hard-to-schedule breast MRI and enhance patient care.

Delivering Better Patient Care

The European Council revisions to breast screening guidelines now recognize DBT as the preferred mammography imaging system. This landmark recommendation acknowledges the extensive body of research on and benefits of DBT, advocating that all women—not just those with dense breast tissue—will benefit from this modality DBT gantries, such as the Hologic 3Dimensions® Mammography System that we use at Zuyderland, have been shown to detect up to 65% more invasive cancers than a 2D mammogram alone[1], and to reduce recall rates compared to full field digital mammography.[2]

The European Council's recommendations also call for the use of breast MRI, where appropriate, to supplement a mammogram. However, there are several limitations to MRI screenings, including scheduling issues for this multi-disciplinary tool that could lead to a delay in breast cancer diagnosis.

Thankfully, CEM utilizes a health care center's existing DBT system, enabling clinicians and radiologists to engage with a technology that is solely based on breast imaging. This triaging can help alleviate demand for breast MRI, while also reducing diagnostic delays. Studies show that CEM and breast MRI both have comparably high sensitivity in the detection of breast lesions[3], meaning CEM can offer a faster[4] alternative to MRI[5] without compromising on results. This can enable more patients throughout the health care system to utilize MRI when it is truly needed and reduce the amount of time between screening and diagnosis for breast cancer patients.

At my own facility, we use CEM throughout the breast health journey, including for evaluating screening recalls, preoperative staging of breast cancer (including invasive lobular carcinomas), problem-solving,

and response monitoring of women treated with neoadjuvant chemotherapy. With the recent updates to European breast cancer screening guidelines, we are also considering including extremely dense breast tissue as an additional indication.

By looking at the entire workflow of breast cancer patients, CEM can be utilized to create fast diagnostic pathways by taking a multi-disciplinary approach, such as contrast-enhanced biopsies to optimize diagnostic workflow. This approach has enabled my facility to see a patient on the morning of day one, and have the entire pre-operative plan completed in the afternoon of day two, even in more complex cases.

Analyzing the Return on Investment

This is a bold statement that needs to be made—CEM alone is not cost effective. This technology is only one part of breast imaging, which is a small percentage of imaging being performed in general radiology departments. Additionally, most countries within the continent do not fully reimburse for CEM. Instead, facilities are reimbursed for the mammogram, excluding the cost of the contrast agent.

That being said, when reviewing the return on investment (ROI) of CEM against imaging overall, there can be significant benefits. As addressed previously, the utilization of CEM opens spaces for other patients to use MRI. At Zuyderland, our department observed a substantial decrease in the number of breast MRI examinations in our hospital when introducing CEM. These MRI slots are immediately consumed by other imaging specialties, which means that the adoption of contrast-enhanced technology is indirectly creating more room on the scanner for patients with other illnesses. So, in terms of cost-efficiency, it might not be beneficial for breast imaging alone, but it could have a positive impact on the department overall.

For health care centers that do not have MRI on-site, CEM also provides an opportunity to keep patients at the facility to help streamline the time between discovery and diagnosis. By utilizing the facility's existing DBT system, patients can remain in-house for supplemental screenings and diagnosis, which helps reduce scheduling delays and streamline radiology workflow. Some studies have shown that CEM can provide comparable diagnostic performance, so all facilities—those with MRI or without—can maintain timely imaging procedures without compromising image quality.[6] Considering the entire spectrum of capabilities that are needed for a mammography unit, state-of-the-art systems like the 3Dimensions gantry enable facilities to support a wide variety of offerings, including CEM, that streamline radiologist and patient workflow.

CEM is a preferred technique at the Zuyderland radiology department because of its availability within the facility and the ease at which supplemental screenings and biopsy procedures can be performed. With the recent adoption of DBT as the preferred screening method in the European Union, CEM has much to offer facilities looking to enhance patient experience while balancing ROI.

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[1] *Results from Friedewald, SM, et al. "Breast cancer screening using tomosynthesis in combination with digital mammography." JAMA 311.24 (2014): 2499-2507; a multi-site (13), non-randomized, historical control study of 454,000 screening mammograms investigating the initial impact the introduction of the Hologic Selenia® Dimensions® on screening outcomes. Individual results may vary. The study found an average 41% increase and that 1.2 (95% CI: 0.8-1.6) additional invasive breast cancers per 1,000 screening exams were found in women receiving combined 2D FFDM and 3D™ mammograms acquired with the Hologic 3D Mammography™ System versus women receiving 2D FFDM mammograms only.*

[2] *Destounis, S. V., Morgan, R., & Arieno, A. (2015). Screening for dense breasts: Digital Breast Tomosynthesis. American Journal of Roentgenology, 204(2), 261–264. https://doi.org/10.2214/ajr.14.13554*

[3] *Gelardi F, Ragaini EM, Sollini M, et al. Contrast-Enhanced Mammography versus Breast Magnetic Resonance Imaging: A Systematic Review and Meta-Analysis. Diagnostics (Basel). 2022 Aug 4;12(8):1890.*

[4] *Hobbes M, Taylor D, Buzynski S, et al. "Contrast-enhanced spectral mammography (CESM) and contrast enhanced MRI (CEMRI): Patient preference and tolerance" J Med Imaging Radiat Oncol. 2015 Jun;59(3):300-5. [Epub 2015 Apr 21].*

[5] *Patel BK, Gray RJ, A Pockaj BA. Potential Cost Savings of Contrast-Enhanced Digital Mammography. AJR Am J Roentgenol 2017 Jun;208(6): W231-W237.*

[6] *Cozzi A, Magni V, Zanardo M, et al. Contrast-enhanced Mammography: A Systematic Review and Meta-Analysis of Diagnostic Performance. Radiology. 2022 Mar;302(3):568-581.*