

# Contrast-enhanced spectral mammography in clinical practice

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## **Valorisation**

## **Social impact**

Breast cancer is one of the leading causes of cancer death among women worldwide. The Dutch breast cancer screening program, established to detect (early stage) breast cancer, has seen a recall rate of 2-3%. Approximately 70% of these recalls prove to be false positives.

Radiological abnormalities that later prove erroneous engender unnecessary anxiety and needless follow-up testing, which in turn generates unnecessary health care costs. Rapid clarification to establish a final diagnosis is especially important in the work-up of these patients.

## **Relevance of this thesis**

In this thesis, our aim was to demonstrate that Contrast enhanced spectral mammography (CESM) is feasible and safe in clinical practice. We also assessed image quality and evaluated if this new technique did not come at the expense of unacceptable radiation exposure. Our research therefore focused on women recalled from the breast screening program who underwent CESM as part of their clinical work-up. CESM was found to be superior to conventional digital mammography despite the relatively low disease prevalence in this population. However, breast cancer CESM is not an option because the radiation dose still exceeds that of mammography, and CESM requires intravenous administration of iodine-based contrast agents.

Currently, Dutch women recalled from the screening program are informed by their general practitioner and referred to a breast cancer clinic of their choice for further analysis. Due to existing waiting lists a delay of several days is common before the patient is seen by a nurse practitioner or surgeon, who then refers the patient to the Radiology department for further imaging and/or biopsy. Since recall is based on the detection of a radiological abnormality one might consider changing the approach in order to shorten the diagnostic pathway. This could be achieved through direct referral to an (expert breast-) radiologist who could rapidly discriminate between benign lesions (such as superposition or cyst) and lesions that need further work-up.

As discussed in this thesis, the use of CESM not only allows for more accurate breast cancer detection than conventional mammography, but also for more confident detection of false positive recalls. This could abolish the need for mammographic follow-ups after six, twelve or even eighteen months. In addition, CESM technique has the potential to replace breast MRI in preoperative assessment.

Rapid access and implementation of an 'intermediate stage' between screening and referral to a breast clinic. The results of this thesis advocate such an approach in

which CESM plays a significant role. This could have several potential benefits: (1) less interval cancers due to the higher diagnostic accuracy of CESM as compared to conventional mammography; (2) reduced patient anxiety due to rapid access and confident diagnosis of false positive recalls; and (3) reduction in health care costs due to the absence of unnecessary downstream testing.

## Target groups

The results of this thesis may be of interest to radiologists, radiology departments, breast care clinics and last but not least, the patients themselves.

When using CESM, diagnostic accuracy will increase regardless of radiologist experience. CESM can therefore be introduced without any significant learning curves. In addition, CESM provides potential downstream benefits such as the avoidance of more time-consuming, invasive or costly tests (e.g. ultrasound, MRI or biopsies). From a technical perspective, most (modern digital) mammography units can be upgraded to include CESM technology; no additional equipment is required (although an automated injector is recommended for standardized intravenous contrast delivery).'

In addition to its use as problem-solving modality for women recalled from the breast screening program, CESM has numerous other potential indications such as inconclusive full-field digital mammography findings, neoadjuvant chemotherapy response monitoring, high risk patient screening, breast-conserving therapy evaluation, and unknown primary tumour evaluation, which are currently all breast MRI indications. Since breast MRI is not widely available in most countries even in Europe, upgrading existing mammography units with CESM could improve the diagnostic imaging chain. Furthermore, CESM might serve as an excellent alternative where contraindications for breast MRI exist (obesity, claustrophobia, metal implants, etc.).

Primary use of CESM in breast care clinics can reduce the number of false positives referred from cancer screening. This would lead to an increased cancer prevalence in the recall population visiting the breast cancer clinics, enabling a focus shift from ruling out suspected malignancy to (true) breast cancers. A CESM-based work-up would also reduce the number of short-term follow-up lesions (so called BI-RADS 3), and accelerate the diagnostic pathway, frequently rendering breast MRI superfluous.

An advantage for patients is the increased specificity of CESM which will reduce the number of recalls, and since CESM is a straightforward imaging method, early access would reduce recall-patient anxiety. CESM was originally developed as an aid in the detection of breast cancer in women with dense breast tissue, and therefore, it could be of great interest for patients with dense breasts.

Even though CESM is a rather novel modality in the field of breast imaging, studies showing its strong potential and clinical relevance are being published in rapid succession, resulting in an increased number of units being installed worldwide. Over the next few years CESM is expected to become accepted as one of the standard breast imaging modalities, offering immediate solutions for a relevant clinical and social problem.