Contrast Enhanced Mammography: The added value in the assessment of Suspicious Breast Lesions

Thesis

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By

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LIST OF ABBREVIATIONS

ACR	American College of Radiology
AGD	Average Glandular Dose
BC	Breast Cancer
BIRADS	Breast Imaging Reporting and Data System
BRCA 1	Breast Cancer Gene 1
BRCA 2	Breast Cancer Gene 2
CBS	Conservative Breast Surgery
CC	Craniocaudal
CEDM	Contrast Enhanced Digital Mammography
CESM	Contrast Enhanced Spectral Mammography
DCIS	Ductal Carcinoma In situ
DE-CEDM	Dual Energy CEDM
ER-Positive	Estrogen Receptor Positive
ETD	Extralobular Terminal Duct
FDA	Food and Drug Administration
FN	False Negative
FP	False Positive
HRT	Hormone Replacement Therapy
ICC	Invasive Cribriform Carcinoma
IDC	Invasive Ductal Carcinoma
ILC	Invasive Lobular Carcinoma
ITD	Intralobular Terminal Duct
LCIS	Lobular Carcinoma In situ
LT	Left
ML	Mediolateral
MLO	Mediolateral Oblique
MRI	Magnetic Resonance Imaging
NPV	Negative Predictive Value
NST	No special type
PPV	Positive Predictive Value
RT	Right
SM	Sonomammography

TC	Tubular Carcinoma
TDLU	Terminal Duct Lobular Unit
TN	True Negative
TP	True Positive
UOQ	Upper Outer Quadrant
US	Ultrasound

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Introduction

Breast cancer in women is a major public health problem throughout the world. It is the most common cancer among women both in developed and developing countries, accounting for 22.9% of all new female cancers. In Egypt 2008, breast cancer accounting for 37.7% of the total new cancer cases and it is the leading cause of cancer related mortality accounting for 29.1% of the cancer related deaths (***Zeeneldin et al, 2013***).

Mammography is the basic breast imaging modality for early detection and diagnosis of breast cancer (***van den Biggelaar et al, 2009***). Despite advances in mammography, at least one in four malignant tumors remains undetected using screening mammography alone; in dense breast tissue, more than half go undetected ***(Diekmann et al, 2011)***. Unfortunately it also has a high false-negative rate. False-negatives can be attributed to the existing technological limitations of mammography, human error, and quality assurance failures (***Chang et al, 2008***)

Ultrasound is a complementary technique to mammography, especially for dense breasts and is a part of the standard of care

in diagnostic procedures. Manual US examinations are time-consuming operator dependent and findings have to be characterized during the procedure with limited possibility of a second independent evaluation of already captured images (***Dromain et al, 2011)***

Taking advantage of the inherent capabilities of image processing in digital mammography, advanced applications may bring additional clinical and cost benefits to the current standard of care. Among these applications, contrast-enhanced digital mammography (CEDM) may specifically open the door to detection of angiogenesis in the mammography suite. (***Dromain et al, 2011)***

In diagnostic imaging neo-angiogenesis is recognized as a classic sign of malignant tumors. Breast cancer is usually diagnosed by mammography showing a suspicious lesion or microcalcifications, but this imaging method does not visualize neo-angiogenesis. The addition of Doppler US makes visualization of blood flow possible. However, it is known that slow blood flow may go undetected by this method. Contrast-enhanced mammography is a relatively new imaging technique capable of detecting neoangiogenesis and has the potential to

play an important role in assessing multifocality or multicentricity in breast cancer (***Daniaux et al, 2015)***

The potential clinical applications are the clarification of mammographically equivocal lesions, the detection of occult lesions on standard mammography, particularly in dense breast, the determination of the extent of disease, the assessment of recurrent disease and the monitoring of the response to chemotherapy (***Dromain et al, 2009***).

The preliminary clinical trial suggests that dual-energy CEDM has a higher diagnostic accuracy for the detection of breast carcinoma compared with mammography alone and with mammography interpreted in association with ultrasound (***Dromain et al, 2011***).