

# **Comparison between the role of contrast enhanced mammography and dynamic contrast enhanced MRI in assessment of breast cancer recurrence**

*Thesis*

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## List of Abbreviations

<b>Acc</b>	Overall accuracy
<b>ACR</b>	American Colleague Radiology.
<b>AGD</b>	Average glandular dose
<b>BC</b>	Breast cancer
<b>BCT</b>	Breast conservative therapy
<b>BLBC</b>	Basal like breast cancer
<b>BIRADS</b>	Breast Imaging Reporting and Data System.
<b>BMRI</b>	Breast magnetic resonance imaging
<b>BPE</b>	Background parenchymal enhancement
<b>CBS</b>	Conservative breast surgery
<b>CC</b>	Cranio- Caudal
<b>CESM</b>	Contrast Enhanced spectral Mammography
<b>CK</b>	Cytokeratins
<b>CLBC</b>	Claudin low breast cancer
<b>DCE-MRI</b>	Dynamic contrast enhanced magnetic resonance imaging
<b>DCIS</b>	Ductal carcinoma in situ.
<b>DECE</b>	Dual Energy Contrast Enhanced
<b>eGFR</b>	Estimated Glomerular Filtration Rate
<b>EGFR</b>	Epidermal growth factor receptor
<b>ER</b>	Estrogen receptor
<b>FFDM</b>	Full-Field Digital Mammography
<b>FGT</b>	Fibro-glandular tissue
<b>FM</b>	Fibrocystic Mastopathy
<b>FN</b>	False negative
<b>FOV</b>	Field of vision.

<b>FP</b>	False positive.
<b>Gd</b>	Gadopentetate-dimeglumine
<b>Gd-DTPA</b>	Gadolinium diethylene triamine penta acetic acid
<b>HE</b>	High energy
<b>HER 2</b>	Human Epidermal Growth Factor Receptor 2
<b>IDC</b>	Invasive Ductal Carcinoma
<b>IHC</b>	Immune-histochemistry
<b>ILC</b>	Invasive Lobular Carcinoma
<b>IV</b>	Intra venous
<b>LCIS</b>	Lobular carcinoma in situ.
<b>LE</b>	Low energy
<b>LIQ</b>	Lower inner quadrant
<b>LN</b>	Lymph node.
<b>LOQ</b>	Lower outer quadrant
<b>LR</b>	Local recurrence
<b>MABC</b>	Molecular apocrine breast cancer
<b>MBC</b>	Metaplastic Breast Cancer
<b>MIP</b>	Maximum intensity projection
<b>ML</b>	Medio Lateral
<b>MLO</b>	Medio Lateral Oblique
<b>MPR</b>	Multi-planar reconstruction
<b>MRI</b>	Magnetic Resonance imaging
<b>NCI</b>	National Cancer Institute
<b>NME</b>	Non mass enhancement
<b>NPV</b>	negative predictive value
<b>PPV</b>	Positive Predictive Value
<b>PR</b>	Progesterone receptor

<b>ROC</b>	Receiver Operating Characteristic Curve
<b>ROI</b>	Region of interest
<b>SENSE</b>	Sensitivity
<b>SNR</b>	Signal to noise ratio
<b>Spec</b>	specificity
<b>SI</b>	Subtracted images
<b>S-RT</b>	Surgery- radiotherapy
<b>T</b>	Tesla
<b>TDLU</b>	Terminal ductal-lobular units.
<b>TE</b>	Time echo
<b>TN</b>	True negative.
<b>TNBCs</b>	Triple Negative Breast Cancers
<b>TNM</b>	Tumor, nodes, metastases
<b>TP</b>	true positive
<b>TR</b>	Time repetition
<b>UIQ</b>	Upper inner quadrant
<b>UOQ</b>	Upper outer quadrant
<b>US</b>	Ultrasound.
<b>XXCL</b>	Exaggerated Cranio Caudal Lateral
<b>XXCM</b>	Exaggerated Cranio Caudal Lateral

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## **Introduction**

Breast cancer is most prevalent and is the leading cause of cancer related deaths among women worldwide (*Sharma et al., 2008*).

After surgical resection, recurrence of breast cancer is a major clinical problem (*Drukteinis et al., 2012*). Cancer stage for stage mortality is worse in recurrence in the conserved breast than for the same sized tumors when it is originally diagnosed, however as with the original cancer, the earlier the diagnosis of the recurrence, the better the outcome (*Li et al., 2010*).

Mammography is a well established, cost effective imaging technique for breast cancer detection (*Dormain et al., 2011*), but imaging the treated breast presents challenges because of its limited compressibility and the overlapping features of benign post-treatment alterations and tumor recurrence (*Chansakul et al., 2012*). Mammography's ability to detect recurrence has been calculated as one third less than its ability to discover the original cancer (*Brennnan et al., 2010*) and this sensitivity is reduced to 62.9% in dense breast (compared to 87% in fatty breast) which can lead to superimposition artifact and thereby obscure lesions.

Contrast agent has been used for many years by both CT and MR techniques to explore angiogenesis in breast carcinoma

by tracking the uptake and washout of contrast agent in tissue (*Dromain et al., 2010*). Two promising techniques may overcome the digital mammography limitations and increase its sensitivity include contrast enhanced mammography with subtraction and tomosynthesis -cross sectional technique- (*Diekmann et al., 2007*).

CEDM is a new advanced application of digital mammography using the intravenous injection of an iodinated contrast agent in conjunction with a mammography examination. Two basic techniques of contrast enhanced mammography are present: temporal subtraction and dual-energy techniques (*Dromain et al., 2010*).

The potential clinical applications of the CEDM are determination of the extent of disease, assessment of recurrent disease, clarification of mammographically equivocal lesions, detection of occult lesions on standard mammography, particularly in dense breast, and monitoring the response to chemotherapy (*Dromain., et al 2010*), so it is a functional imaging technique depending on histological characters of the tumor as well as contrast agent pharmacology, similar to MRI in function (*Jochelson et al., 2013*)

Magnetic resonance (MR) imaging of the breast is increasingly used as an adjunct to mammography and

ultrasonography (US) to improve the detection and characterization of primary and recurrent breast cancers and for evaluation of the response to therapy. MR imaging is useful for detecting multifocality and multicentricity of breast cancer, differentiating between scar tissue and recurrent cancer after breast-conserving therapy, examining breasts that contain implants, In patients with a finding of cancer in one breast, screening the contralateral breast for occult cancer, as well as in examining the breasts of patients with histologically proved metastatic breast cancer with unknown primary origin (*Macura et al., 2008*).

However the advantage of MRI in staging and detection of recurrence needs to be balanced with its disadvantages : greater expense, lack of accessibility, and frequency of false positive examinations (*Jochelson et al., 2013*).