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

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

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

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