



The Value of Dynamic Contrast-Enhanced MRI in the Diagnosis and Management of Triple Negative Breast Cancer

Thesis

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Diagnostic Radiology**

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Abstract

Breast cancer (BC) is by far the world's most common cancer among women, and it is the most common cause of cancer related death in women worldwide. **Triple negative breast cancer (TNBC)** is a subtype of breast cancer that lacks expression of estrogen receptors (ER), progesterone receptors (PR) and human epidermal growth factor receptor 2 (HER2).

TNBC is characterized by distinct clinical, pathological features and don't respond to endocrinal therapy or targeted agents.

Imaging for TNBC represents a diagnostic challenge to breast radiologists, and the aim of this work is to assess the MRI features of TNBC in comparison to other breast cancer subtypes and to validate its impact on management. Contrast-enhanced MRI is an accurate assessment of tumor response after Neo-Adjuvant Chemotherapy and should be incorporated in the evaluation of all patients with TNBC.

Key words: Dynamic Contrast-Enhanced MRI, Triple Negative Breast Cancer, TNBC.

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List of Abbreviations

2D	Two Dimensional
3D	Three Dimensional
ACR	American College of Radiology
AR	Androgen Receptor
BC	Breast Cancer
BIRADS	Breast Imaging Reporting And Data System
BL 1 and 2	Basal-Like 1 and 2
BRCA 1 and 2	Breast Cancer gene 1 and 2
BPE	Background Parenchymal Enhancement
CAD	Computer Aided Detection/Diagnosis
CC	Cranio-Caudal
CK	Cytokeratin
DCE-MRI	Dynamic Contrast Enhanced-Magnetic Resonance Imaging
DFS	Disease Free Survival
DNA	Deoxyribo Nucleic Acid
ECD	Extra-Cellular Domain
EGFR	Epidermal Growth Factor Receptor
EMT	Epithelial Mesenchymal Transition
ER	Estrogen Receptor
FGT	Fibro-Glandular Tissue
FLASH	Fast Low Angle Shot
FSPGR	Fast Spoiled Gradient Recalled echo
F/U	Follow Up
G2	Grade 2
Gd-DTPA	Gadolinium-Diethylene Tri amino Penta acetic Acid

GE	Gene Expression
HER 1 and 2	Human EGFR Related 1 and 2
HER-2/neu	Human EGFR Related-2/neural
HR	Hormon Receptor
IDC	Invasive Ductal Carcinoma
IM	ImmunoModulatory
IV	Intra-Venous
K.Curve	Kinetic Curve
Ki-67	A nuclear proliferation-associated Ag found in microwell N° 67 at Kiel University
LAR	Luminal Androgen Receptor
LIQ	Lower Inner Quadrant
LOQ	Lower Outer Quadrant
M	Mesenchymal
MBD/MGD	Mammographic Breast Density
MIP	Maximum Intensity Projection
MLO	Medio-Lateral Oblique
MR/MRI	Magnetic Resonance Imaging
MSL	Mesenchymal Stem-Like
NAC / NACT	Neo-Adjuvant Chemotherapy
NME	Non-Mass Enhancement
NR	Nuclear Receptor
NST	No Special Type
OS	Overall Survival
pCR	Pathological Complete Response/Remission
PFS	Progression-Free Survival
PR	Progesteron Receptor
P.value	Probability value

RECIST	Response Evaluation Criteria In Solid Tumors
RF	Radio-Frequency
RFS	Relapse-Free Survival
ROI	Region Of Interest
RSE	Relative Signal Enhancement
SD	Standard Deviation
SI	Signal Intensity
SPSS	Statistical Product for Services Solutions
STIR	Short Time Inversion Recovery
T	Tesla
T 1	Longitudinal relaxation
T 2	Transverse relaxation
TDLU	Terminal Ductal Lobular Unit
TE	Time to Echo
THRIVE	T1 High Resolution Isotropic Volumetric Examination
TMC	Typical Medullary Carcinoma
TN	Triple Negative
TNBC	Triple Negative Breast Cancer
TR	Time to Repetition
TRAM	Trans-Rectus Abdominus Myocutaneous
UIQ	Upper Inner Quadrant
UOQ	Upper Outer Quadrant
US	UltraSound
VIBRANT	Volume Imaging for Breast Assessment
WHO	World Health Organization
WI	Weighted Image

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INTRODUCTION

Breast cancer (BC) is by far the world's most common cancer among women, and it is the most common cause of cancer related death in women worldwide (522,000 deaths in 2012) (*Ferlay, et al, 2013*).

Triple-negative breast cancer (TNBC) is a subtype of breast cancer that lacks expression of estrogen receptors (ER), progesterone receptors (PR) and human epidermal growth factor receptor 2 (HER2). They account for about 12–26% of all breast cancers, and are associated with a more aggressive clinical course and poor prognosis. They have a higher rate of local recurrence and metastatic disease, with a 5-year survival rate of approximately 75% (*Krizmanich-Conniff, et al, 2012*)(*Golden, et al, 2013*). The incidence of TNBC is higher in younger, usually premenopausal women (*Sung, et al, 2013*)(*Osman, et al, 2014*).

Imaging of TNBC represents a diagnostic challenge to breast radiologists. On mammography and ultrasound, triple-negative cancer shows indistinct features that can mimic lesions with benign morphology (*Youk, et al, 2012*). Patients with TNBC are usually young with BRCA gene mutation and they have dense breasts which further decreases mammography sensitivity and specificity. The rapid progression of the TNBC that is not associated with architectural distortions makes early identification of the disease very difficult (*Boisserie-Lacroix, et al, 2013*).