



Role of Dynamic Contrast Enhanced MRI & Diffusion Weighted Imaging in Evaluation of H.C.C After Chemo-Embolization

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
3D	Three-dimensional
AASLD.....	Association for the study of liver diseases
ADC	Apparent diffusion coefficient
AFP	Alpha fetoprotein
APF.....	Arterioportal fistula
APHE.....	Arterial phase hyper-enhancement
BBEPI	Black-blood echo-planar imaging
BCLC.....	Barcelona clinic liver cancer
CNR.....	Contrast-to-noise ratio.
DCE MRI	Dynamic contrast-enhanced mri
DEB-TACE.....	Drug-eluting beads transarterial chemoembolization
DM.....	Diabetes mellitus
DWI.....	Diffusion-weighted magnetic resonance imaging
ETL.....	Echo train length
FL.....	Falciform ligament
FSE/TSE.....	Fast/turbo spin echo
GRAPPA	Generalized auto- calibrating partially parallel acquisition
GRE	Gradient echo
H.C.C	Hepatocellular carcinoma
HASTE	Half acquisition single shot turbo echo
HIV	Human immunodeficiency virus
IBR.....	Institutional board review
ICC.....	Intrahepatic cholangiocarcinoma
IP.....	In-phase
IVC.....	Inferior vena cava

List of Abbreviations Cont...

Abb.	Full term
IVIM	Intravoxel incoherent motion
LAVA	Liver acquisition with volume acceleration
Lga.....	Left gastric artery
Lha	Left hepatic artery
LHV	Left hepatic vein
LI-RADS	Liver imaging-reporting and data system
LR-TIV	LR-tumor in vein
LR-TR.....	Liver imaging reporting and data system treatment response
LV.....	Ligamentum venosum
MDCT	Multi-detector computed tomography
Mha.....	Middle hepatic artery
MHV	Middle hepatic vein
MIP	Maximum intensity projection
MRCP.....	Magnetic resonance cholangiopancreatography
MRI.....	Magnetic resonance imaging
NEX	Number of excitations
NPV	Negative predictive value
NSF	Nephrogenic systemic fibrosis
OLT	Orthotropic liver transplantation
OP	Out-of-phase
PEI.....	Percutaneous ethanol injection
PI.....	Parallel imaging
PPV	Positive predictive value
RF.....	Radiofrequency.
RFA	Radiofrequency ablation
Rha	Right hepatic artery

List of Abbreviations Cont...

Abb.	Full term
RHV.....	Right hepatic vein
RT	Radiation therapy
R-T.....	Respiratory-triggered
SE.....	Single-shot spin-echo
Sma	Superior mesenteric artery
SNR.....	Signal to noise ratios.
SPAIR	Spectrally adiabatic inversion recovery
SPIO	Superparamagnetic iron oxide particle
SPSS	Statistical package for the social sciences
SSFSE	Single shot fast spin echo.
STIR.....	Short time inversion recovery sequences
TACE.....	Trans-arterial chemo-embolization
TAE	Trans-arterial embolization
TARE	Trans arterial radio-embolization
TE.....	Echo time
TR.....	Time of repetition
TVDT	Tumor volume doubling time
WO	Wash-out

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Introduction

INTRODUCTION

Hepatocellular carcinoma (HCC) is the most common primary malignant disease of the liver and is the third leading cause of death from cancer worldwide (*Bonekamp et al., 2013*).

Only a minority of all patients with HCC are surgical candidates at the time of diagnosis (*Wang et al., 2014*).

Treatment options are divided into surgical therapies (i.e., resection, cryoablation and orthotopic liver transplantation (OLT), and nonsurgical therapies (i.e., percutaneous ethanol injection (PEI), radiofrequency ablation (RFA), trans-arterial chemo-embolization (TACE), radiation therapy (RT) and systemic therapy) (*Curley et al., 2017*).

Transcatheter arterial chemoembolization (TACE) is one of the most commonly used intra-arterial therapies to treat unresectable HCC, and several clinical trials have demonstrated that TACE has the potential to show survival benefits in patients with HCC. TACE is a frequently used technique and usually includes intra-arterial delivery of emulsions mixed with chemotherapeutic agents and lipiodol, followed by the administration of the embolic agent (*Wang et al., 2014*).

Assessing early response to therapy using objective criteria is paramount for clinical care. Identifying early responders could help individualize therapy and tailor future treatment strategies (*Bonekamp et al., 2013*).

Usually the presence of residual viable tumor or recurrence after TACE is assessed using multi-phasic multi-detector computed tomography (MDCT) scanning, but this technique can be affected by artifacts produced by high concentrations of lipiodol, making it difficult to evaluate the characteristics of the lesion. Response may be better assessed by noting alterations in vascular tumor perfusion rather than size, and therefore functional measurements may be an appropriate method to assess tumor response (*Ippolito et al., 2010*).

MRI provides anatomic parameters, as well as functional and molecular parameters, for the assessment of the response to treatment. Non-contrast T1- and T2-weighted images provide information on morphological change, fluid content change and fibrosis. Dynamic contrast enhanced MRI can provide information on perfusion (*Osama et al., 2013a*).

Dynamic contrast-enhanced MRI (DCE MRI) can play a significant role as an imaging biomarker, especially in the detection of viable tumor foci, the differentiation between necrosis and viable tumor and early prediction of response (*Lee et al., 2011*).

Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) also enables tumor vascular physiology to be assessed (*Chen and Shih, 2014*).