Role of Advanced MRI Techniques in Characterization of Hepatic Nodules in Liver Cirrhosis

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Presented by

Noha Mohamed Taha Abdel Hak

M.B., B. Ch., M. Sc
Faculty of Medicine
Ain Shams University

Supervised by

Prof. Dr. Omar Hussien Omar

Professor of Radiology
Faculty of Medicine
Ain Shams University

Prof. Dr. Sahar Mohamed El Gaafary

Professor of Radiology
Faculty of Medicine
Ain Shams University

Prof. Dr. Eman Ahmed Shawky Geneidi

Professor of Radiology
Faculty of Medicine
Ain Shams University

Prof. Dr. Heba Mohamed Mohamed Abdella

Professor of Tropical medicine
Faculty of Medicine
Ain Shams University

Dr. Ayman Mohamed Ibrahim

Ass. Professor of Radiology
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University

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وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

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Noha Mohamed Taha

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List of Abbreviations

2D	Two dimentional.
3D	Three dimensional.
AASLD	American Association for the Study of Liver Diseases.
ADC	Apparent diffusion coefficient.
AFP	Alpha feto-protein.
AJCC	American Joint Committee on Cancer
APS	Arterio-portal shunts.
ART	Arterial.
BBEPI	Black-blood echoplanar imaging.
BCLC	Barcelona Clinic Liver Cancer
CHA	Common hepatic artery.
CT	Computed tomography.
DCE-MRI	Dynamic contrast enhanced- magnetic resonance imaging
DEL	Delayed
DNs	Dysplastic nodules.
DSC-MRI	Dynamic susceptibility contrast-magnetic resonance imaging.
DW	Diffusion weighted.
DWI	Diffusion weighted imaging.
EPI	Echo planner imaging.
FIESTA	Fast imaging employing steady state acquisition sequence.
FOV	Field of view.
FRFSE	Fast recovery fast spin echo.
FSE	Fast spin echo.
FSPGR	Fast spoiled gradient.
Gd-DTPA	Gadolinium-diethylenetriaminepentaacetic acid.
Gd-EOB-DTPA	Gadolinium ethoxybenzyldiethylenetriaminepentaacetic acid
GRE	Gradient recalled echo
HA	Hepatic artery
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus
ICC	Intra-hepatic cholangiocarcinoma
IP	In-phase
IVC	Inferior vena cava
LI-RADS	Liver Imaging-Reporting And Data System

List of Abbreviations

ME	Maximum enhancement
MIP	Maximum intensity projection.
MRE	Maximum relative enhancement
MRI	Magnetic resonance imaging.
ms	millisecond
NEX	Number of excitations.
OP	Out-of-phase.
PACS	Picture archiving and communication system
PET	Positron-emission tomography
PI	Parallel imaging.
PST	Performance status test
PV	Portal vein
RE	Relative enhancement
RES	Reticuloendothelial system
RFA	Radio-frequency ablation
RNs	Regenerative nodules.
ROI	Regions of interest
s/mm^2	Second per square millimeter.
Sat	Saturation.
SE	Spin echo.
SI	Signal intensity.
SNR	Signal to noise ratio.
SPIO	Superparamagnetic iron oxide.
SSTSE	Single shot turbo spin echo.
T	Tesla.
TACE	Trans-arterial chemoembolization
TE	Echo Time
THRIVE	T1-weighted high resolution isotropic volume examination.
TR	Repetition time
True-FISP	True fast imaging with steady state precession
TSE	Turbo spin echo.
TTP	Time to peak
US	Ultrasound
VIBE	Volumetric interpolated breath hold examination.
WI	Weighted images

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Introduction

Liver cirrhosis is characterized by irreversible remodeling of the hepatic architecture with bridging fibrosis and a spectrum of hepatocellular nodules. Cirrhosis-associated hepatocellular nodules result from the localized proliferation of hepatocytes and their supporting stroma in response to liver injury **(Robert et al., 2008).**

Hepatitis C virus (HCV) is the most important etiologic factor of liver cirrhosis. The burden of liver cirrhosis in Egypt is exceptionally high, owing to it maintaining the highest prevalence of hepatitis C virus worldwide **(Lehman, 2008).**

Cirrhosis is characterized by a spectrum of hepatocellular nodules that mark the progression from regenerative nodules to low- and high-grade dysplastic nodules, followed by small and large hepatocellular carcinomas **(Parente et al., 2012).**

The differentiation of these lesions is important because regenerative nodules are benign, whereas dysplastic and neoplastic nodules are premalignant and malignant, respectively **(Quaia et al., 2013).** Early detection of HCC is necessary for more effective planning of management strategies like tumor resection, liver transplantation, tumor ablation and chemo-embolization **(Digumarthy et al, 2005).**

Biopsy of all lesions detected in cirrhotic livers is neither feasible nor advisable. As an alternative, magnetic resonance imaging (MRI) represents an extremely useful method of detection and characterization of regenerating nodules, dysplastic nodules and HCC **(Byrnes et al, 2007).**

MR imaging is more useful than computed tomography for such assessments because it provides better soft-tissue contrast and a more nuanced depiction of different tissue properties. Familiarity with the MR imaging characteristics of cirrhosis-associated hepatocellular nodules is therefore important for optimal diagnosis and management of cirrhotic disease **(Robert et al., 2008).**

Triphasic contrast-enhanced MRI produces images of the arterial, porto-venous and delayed phases that not only precisely depict anatomy and contrast medium uptake, but also contain vascular information **(Lee and Choi, 2011).** The addition of T2 WIs findings to dynamic images improves the diagnostic accuracy and sensitivity in the detection of HCC **(Qu et al, 2012).**

DWI has been shown to be a valuable tool in both detection and characterization of focal liver lesions **(Kim et al, 2011).** As the technique is susceptible to changes in cellular structure, it offers the possibility to detect HCC earlier than contrast enhanced techniques, which require sufficient neo-vascularization for contrast-uptake **(Vandecaveye et al, 2007).**

Perfusion magnetic resonance imaging refers to imaging of tissue blood flow, also dynamic contrast enhanced MRI technique with tracer kinetic modeling allows for the quantitative characterization of parenchymal alterations in the liver **(Bachir et al., 2013).**

Destruction of tumor cells is achieved by either percutaneous ablative techniques or transarterial chemoembolization (TACE). Percutaneous ablative techniques are done by chemical substances (ethanol, acetic acid, boiling saline) or by modifying the temperature (radiofrequency, microwave, laser, cryotherapy). TACE means selective hepatic artery obstruction by using usually gelfoam combined with prior