

The Role of Recent MRI Applications in Differentiation of Hepatic Focal Lesions

Essay

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَأَنْزَلَ اللَّهُ عَلَيْكَ
الْكِتَابَ وَالْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ تَكُنْ
تَعْلَمُ وَكَانَ فَضْلُ
اللَّهِ عَلَيْكَ عَظِيمًا

صدق الله العظيم



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Contents

Subject	Page No.
List of Abbreviations.....	i
List of Tables.....	ii
List of Figures	iii
Introduction	1
Aim of the Study	4
Chapter (1): Gross and MRI Anatomy of the Liver	5
Chapter (2): Physics of MRI	16
Chapter (3): Technique of MRI	31
Chapter (4): Interpretation and MRI Findings	61
Summary	117
References	120
Arabic Summary	—

List of Abbreviations

<i>Abbrev.</i>	<i>Full term</i>
MRI	: Magnetic resonance imaging
DWI	: Diffusion-weighted imaging
VIBE	: Volumetric interpolated breath-hold examination
GRE	: Gradient-recalled-echo (GRE)
RARE	: Rapid acquisition with relaxation enhancement
TSE	: Turbo spin echo
HASTE	: Half-Fourier acquisition single-shot turbo spin echo
STIR	: Short TI inversion-recovery (STIR)
DW	: Diffusion-weighted
SNR	: Signal-to-noise ratio
CT	: Computer tomography
SE	: Spin-echo
SGE	: Spoiled gradient echo
TR	: Repetition time
SPFO	: Super-paramagnetic iron oxides
USPFO	: Ultra small super-paramagnetic iron oxides
HCC	: Hepatocellular carcinomas
Gd	: Gadolinium
CCC	: Cholangio cellular carcinoma
DEL	: Delayed phase image
FNH	: Focal nodular hyperplasia
ART	: Axial arterial phase image
NRH	: Nodular Regenerative Hyperplasia

List of Tables

<i>Table No.</i>	<i>Title</i>	<i>Page No.</i>
Table (1):	Mechanisms of effect and clinical properties of contrast agents used in liver MR imaging examination.....	44
Table (2):	The extra-cellular and hepatocyte-selective Gadolinium chelate used in liver MRI examination.....	44
Table (3):	Super-paramagnetic iron oxide used in liver MR examination and RES-specific contrast agent sal100ml in 5% glucose with 30 minute infusion R1:T1 relaxivity.....	55

List of Figures

<i>Figure No.</i>	<i>Title</i>	<i>Page No.</i>
Figure (1):	Segmental anatomy	5
Figure (2):	Schematic presentation of the liver segments	7
Figure (3):	On a frontal view of the liver the posteriorly located segments 6 and 7 are not visible.	8
Figure (4):	Segmental anatomy	9
Figure (5):	LEFT: at the level of the right portal vein. RIGHT: at the level of the splenic vein.	9
Figure (6):	Hypertrophy of caudate lobe in a patient with liver cirrhosis. Notice the small lobulated right hemiliver.	10
Figure (7):	Anterior view of the liver	11
Figure (8):	Plain MR images. On T1 (a) and T2 (b) weighted plain images with the hepatic veins as landmarks are visible.	13
Figure (9):	Imaging Landmarks for Segmental Lesion Localization.	14
Figure (10):	T1-weighted noncontrast axial image Left lobe (anteroposterior diameter on the left para vertebral line): up to 5 cm.	14
Figure (11):	Axial T2 WI showing GB diameter up to 5 cm (double arrow) with Width of gallbladder wall: 1–3 mm, common bile duct (black arrow) less than 8mm	14
Figure (12):	Coronal image showing Portal vein diameter up to 1.5 cm	15

List of Figures (Cont.)

Figure No.	Title	Page No.
Figure (13):	T2-weighted axial image after the i. v. administration of a super paramagnetic contrast agent showing right hepatic vein.....	15
Figure (14):	FNH, drawings. T2 fat sat	66
Figure (15):	FNH, large typical MRI findings at 3.0T.....	67
Figure (16):	FNH (same patient as shown above) and gross pathology (another patient).....	68
Figure (17):	FNH, very bright on T2 and with a dark central scar, drawings. T2 fatsat.....	69
Figure (18):	FNH, very bright on T2 with a dark central scar, MRI findings.....	70
Figure (19):	Nodular regenerative hyperplasia after Gd-BOPTA. ral rim can be seen.....	72
Figure (20):	Adenoma, drawings. T2 fatsat.....	75
Figure (21):	Adenoma, typical MRI findings.....	76
Figure (22):	Abscess, pyogenic type, drawings.....	77
Figure (23):	Abscess, pyogenic type, MR imaging findings at 3.0T.....	78
Figure (24):	(Left) GE T1-weighted MR image shows a round homogeneously hypo intense lesion (Right) TSE STIR T2-weighted MR image shows the same lesion as isointense to the surrounding liver parenchyma.....	80
Figure (25):	Haemangioma, small, drawings.....	82
Figure (26):	Haemangioma, small, typical MRI findings in a patient with suspected liver metastasis.....	83

List of Figures *(Cont.)*

<i>Figure No.</i>	<i>Title</i>	<i>Page No.</i>
Figure (27):	Haemangioma, multiple, MRI findings.	85
Figure (28):	Macro-regenerative nodules in Budd-Chiari syndrome	87
Figure (29):	Dysplastic nodules, cirrhotic liver, drawings. Coronal SSTSE.....	88
Figure (30):	Dysplastic nodules, cirrhotic liver, MRI findings.....	89
Figure (31):	HCC, cirrhosis, large, mosaic, drawings. SSTSE	90
Figure (32):	HCC, cirrhotic liver, large, mosaic pattern, typical MRI findings.....	91
Figure (33):	HCC, cirrhosis, small, drawings.....	93
Figure (34):	HCC, cirrhosis, small, typical MRI findings.	93
Figure (35):	Well-differentiated hepatocellular carcinoma.....	95
Figure (36):	Poorly differentiated hepatocellular carcinoma.	97
Figure (37):	HCC, cirrhosis, nodule-in-nodule, drawings. T2 fat sat	98
Figure (38):	HCC, cirrhotic liver, nodule-in-nodule, MRI findings.....	98
Figure (39):	Carcinoid metastases.	99
Figure (40):	Metastasis, neuroendocrine pancreas tumour metastasis, drawings.....	101
Figure (41):	Metastasis, neuroendocrine pancreas tumour metastasis, MRI findings.....	101

List of Figures (Cont.)

Figure No.	Title	Page No.
Figure (42):	Metastasis, carcinoid with hemorrhage, drawings.	102
Figure (43):	Metastasis, carcinoid with hemorrhage, MR findings.....	102
Figure (44):	Metastases, Gastrinoma, multiple drawings.	103
Figure (45):	Metastases, Gastrinoma, multiple, MRI findings.....	103
Figure (46):	Breast carcinoma metastases, drawings	104
Figure (47):	Breast carcinoma metastases, MRI findings.....	104
Figure (48):	Melanoma metastases, focal, drawings	105
Figure (49):	Melanoma metastases, focal, melanotic, MRI findings.	105
Figure (50):	Hypo vascular HCC and cavernous haemangioma after Gd-BOPTA..	108
Figure (51):	Metastasis, colorectal, drawings	109
Figure (52):	Metastasis, colorectal, MRI findings	109
Figure (53):	Improvement of lesion detection with iron-oxide based contrast- agent (SHU 555A; Resovist).....	111
Figure (54):	Detection of small metastases: Mangafodipir-enhanced vs gadolinium-enhanced MR	111
Figure (55):	Improvement of lesion detection with liver-specific agent in a patient with breast cancer..	112

List of Figures (Cont.)

Figure No.	Title	Page No.
Figure (56):	Unenhanced axial T1-weighted GRE image shows the extensive lesion with a homogeneous low signal and well-defined borders.....	114
Figure (57):	Hilar cholangiocarcinoma (CC), drawings.	115
Figure (58):	Hilar cholangiocarcinoma (CC), MR findings.....	115

Introduction

The detection and characterization of focal hepatic lesions continues to be a daily challenge in the clinical setting. The noninvasive diagnosis of liver lesions is usually achieved with contrast material–enhanced computed tomography and magnetic resonance (MR) imaging (*Elsayes et al., 2005*).

The early detection of focal liver lesions, particularly those which are malignant, is of great importance. The resection of liver metastases of some malignancies (including colorectal cancer) has been shown to improve the survival of patients. Almost all focal liver lesions larger than 10 mm are demonstrated with current imaging techniques but the detection of smaller focal liver lesions is still relatively poor. One of the advantages of magnetic resonance imaging (MRI) of the liver is better soft tissue contrast (compared to other radiologic modalities), which allows better detection and characterization of the focal liver lesions in question. Developments in MRI hardware and software and the availability of novel MRI contrast agents have further improved the diagnostic yield of MRI in lesion detection and characterization (*Coenegrachts et al., 2009*).

Although the primary modalities for liver imaging are ultrasound and computed tomography, recent studies have suggested that MRI is the most sensitive method for

detecting small liver metastatic lesions, and MRI is now considered the pre-operative standard method for diagnosis. Two recent developments in MRI sequences for the upper abdomen comprise unenhanced diffusion-weighted imaging (DWI), and keyhole-based dynamic contrast-enhanced (DCE) MRI (4D THRIVE). DWI allows improved detection ($b = 10 \text{ s/mm}^2$) of small ($< 10 \text{ mm}$) focal liver lesions in particular, and is useful as a road map sequence. 4D THRIVE improves evaluation of focal liver lesions, providing multiple arterial and venous phases, and allows the calculation of perfusion parameters using pharmacokinetic models. 4D THRIVE has potential benefits in terms of detection, characterization and staging of focal liver lesions and in monitoring therapy (*Coenegrachts et al., 2009*).

Magnetic resonance (MR) imaging plays an important role in the evaluation of a wide range of benign and malignant focal hepatic lesions. The use of three-dimensional (3D) gradient-recalled-echo (GRE) sequences such as volumetric interpolated breath-hold examination (VIBE) has improved MR imaging by providing dynamic contrast material-enhanced thin-section images with fat saturation and a high signal-to-noise ratio (*Albrecht et al., 2008*).

This technique demonstrates characteristic enhancement patterns that can be helpful in the diagnosis of various focal

hepatic lesions. These enhancement patterns are seen during specific phases of imaging and include arterial phase enhancement, delayed phase enhancement, peripheral washout, ring enhancement, nodule-within-a-nodule enhancement, true central scar, pseudo central scar and pseudo capsule. Familiarity with these enhancement patterns can help in the identification of specific focal lesions of the liver (*Elsayes et al., 2005*).

Aim of the Study

The aim of the study is to highlight the role of recent MRI applications in differentiation of hepatic focal lesions.