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

Essay

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وأنـزل الله عليك
الكتاب والحكمة
وعَلَّمَكَ مَا لَمْ تَكُن
تَعْلَمُ وكَانَ فَضْلُ
اللَّهِ عَلَيْكَ عَظِيماً

صدق الله العظيم

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List of Abbreviations

Abbrev.	Full term
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

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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 s/mm(2)) of small (< 10 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.