THE ROLE OF DIFFUSION WEIGHTED MRI IN THE DIFFERENTIATION BETWEEN BENIGN AND MALIGNANT HEPATIC FOCAL LESION

Thesis

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Abstract

Introduction: Early detection and diagnosis of hepatic focal lesions are an important step in clinical work, which would allow effective surgical or mini-invasive therapy.

Aim of the Work: The use of MR Diffusion imaging with both low and high B values to detect and differentiate between benign and malignant hepatic focal lesion.

Patient and Methods: This study were includes 30 patients. They are El-Demerdash hospital patients with hepatic focal lesions. Patients underwent US or CT before MR examination.

Result: Thirty patients were included in this study, 20 males and 10 females. There were 24 primary hepatic focal lesions, (36.7% HCC, 3.3% focal nodular hyperplasia, 3.3% cysts, 13.3% hemangiomas, 6.7% cholangiocarcinoma, 16.7% regeneration nodule) and 6 metastatic lesions.

Conclusion: We hope to use DWI to be helpful in the characterization of focal liver lesions, especially if the lesions show non classic appearance of contrast enhancement in Triphasic CT study and in patients with renal insufficiency with inability to use contrast enhancement.

Recommendations: In our opinion, DWI is a useful adjunct to routine liver imaging (i.e. used as an additional sequence to the standard protocol study and not as a unique imaging series); it is fast, requires no intravenous contrast and is non-invasive.

Keywords: Diffusion weighted MRI, Malignant hepatic, Focal lesion

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Contents

List of Abbreviations

ADC : Apparent diffusion coefficient

CCA : Cholangiocarcinoma

DWI : Diffusion-weighted magnetic resonance imaging

FLLs : Focal liver lesions

FNH : Focal nodular hyperplasia

GI : Gastrointestinal

GRAPPA : Calibrating partially parallel acquisition

HCCs : Hepato cellular carcinomas

MR : Resonance imaging

OCP : Oral contraceptive

RARE : Relaxation enhancement

RF : Radiofrequency

ROI : Region of interest

SGE : Spoiled Gradient-Echo

T2WI : T2-weighted imaging

TE : Echo time

TR : Repetition time

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Introduction

Early detection and diagnosis of hepatic focal lesions are an important step in clinical work, which would allow effective surgical or mini-invasive therapy ***(Yau et al., 2014; Wáng et al., 2015 and Loffroy et al., 2015).***

With the advances in magnetic resonance imaging (MR) technology, diffusion-weighted magnetic resonance imaging (DWI) is now widely used as a standard imaging sequence in clinical work and shows its potential benefit in evaluation of the focal hepatic lesions ***(Kwon et al., 2015 and Namimoto et al., 2015).***

DWI with low value can suppress the intra hepatic vascular signal, creating the so-called black blood effect, which improves the detection of small focal liver lesions (FLLs) especially localized near small hepatic vessels. Meanwhile, DWI with low -value has higher imaging quality compared with single shot fast spin-echo sequences ***(Takahara and Kwee, 2012 and Bharwani and Koh, 2013)***.

A substantial number of studies have compared low B-value DWI with T2-weighted imaging (T2WI) for image quality and detection of FLLs. These studies generally showed better performance of DWI with low -value in

terms of lesion detection compared with T2WI ***(Wang et al., 2010).***

DWI with higher b-value mainly reflects diffusion information of water molecules motion within the lesions, which help to improve the characterization of solid FLLs ***(Namimoto et al., 2015)***.

Meanwhile, we found in practice that DWI with higher b -value also enables a better detection of lesions in liver compared with T2WI or other conventional sequences. For example, solid focal liver lesions such as focal nodular hyperplasia and hepato cellular carcinomas (HCCs) sometime can be difficult to be detected on T2WI or even DWI with low b -value due to either iso- or slightly hyper signal intensity to liver parenchyma ***(Hussainet al., 2004 and Chen et al., 2015).***

Diffusion is a physical process that results from the thermally driven, random motion of water molecules. In a container of water, molecules undergo free, thermally agitated diffusion (with a three dimensional Gaussian distribution) ***(Taouli and Koh, 2010).***

The b-value represents the diffusion factor (measured in s/mm^2) and the strength of the diffusion gradients. The ideal b-value for lesion characterization is a trade-off between signal attenuation and perfusion contamination.

This is generally possible using b-values between 400 and 1000 s/mm^2 for liver imaging. Pure diffusion contrast is obtained when using b-values above 1000 s/mm^2. However, image quality can be limited by signal loss that occurs at such high b-values ***(Tejas Parikh et al., 2008).***

Two independent observers reviewed DW (*b* values of 0, 500, and 1000 sec/mm^2) and T2-weighted images for FLL detection and characterization. Reference standard for diagnosis was obtained from consensus review by the two observers of DW, T2-weighted, pathological data, and follow-up imaging results. Apparent diffusion coefficient (ADC) was measured for FLLs identified at consensus review. DW and T2-weighted images were compared for FLL detection and characterization by using a binary logistic regression model. Receiver operating characteristic curve analyses was conducted to evaluate the utility of ADC for diagnosis of malignancy ***(Tejas Parikh et al., 2008).***

Aim of the Work

The use of MR Diffusion imaging with both low and high B values to detect and differentiate between benign and malignant hepatic focal lesion.