The Role of MRI in Characterization of Benign Hepatic Focal Lesions

Thesis

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List of Abbreviations

FLL……. Focal Liver Lesions

MRI ..... Magnetic Resonance Imaging

2D…… Two Dimensions

3D..... Three Dimentions

GRE…… Gradient Recalled Echo

VIBE……..Volumetric Interpolated Breath Hold Examination

IP…… In Phase

OP……Out Of Phase

DWI…….Diffusion Weighted Images

ADC……..... Apparent Diffusion Coefficient

CSF…… Cerebro-Spinal Fluid

CT ..... Computed Tomography

Gd-DTPA ..... Gadolinium Di ethylene Tri amine Penta-Acetic Acid

HCC..... Hepatocellular Carcinoma

SPIO ..... Super Paramagnetic Iron Oxide

TE ..... Time Echo

TR..... Time Repetition

U/S ..... Ultrasonography

FNH…….. Focal Nodular Hyperplasia

HCA…….. Hepatocellular Adenoma

PLAS…… Pyogenic Liver Abscesses

CHFC……... Ciliated Hepatic Foregut Cyst

BCA…….. Biliary Cyst Adenoma

HAE…….. Hepatic Alveolar Echinococcosis

ROI……Region of Interest

NEX…….. Number of Exitation

eTHRIVE…… Enhanced T1 High Resolution Isotropic Volume Examination

BDH……..… Bile Duct Hamartomas

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Introduction

Nowadays, magnetic resonance plays a key role in management of liver lesions, using a radiation-free technique and a safe contrast agent profile ***(Bartolozzi et al., 2012)***.

The heightened soft-tissue resolution and sensitivity to intravenous contrast agents provided by magnetic resonance imaging (MRI) makes it an invaluable problem-solving tool for fully characterizing focal liver lesions (FLL) ***(Acay and Bayramoglu, 2014)***.

The majority of FLL arising in noncirrhotic liver are benign, even in patients with known extra-hepatic malignancy. Cysts, hemangiomas, focal nodular hyperplasias (FNH), and hepatocellular adenomas (HCA) are the most commonly encountered benign lesions ***(Nault, Bioulac–Sage and Zucman–Rossi, 2013).***

A tremendous development of new imaging techniques has taken place during these last years. Maximizing accuracy of imaging in the context of FLL is paramount in avoiding unnecessary biopsies, which may result in post-procedural complications up to 6.4%, and mortality up to 0.1% ***(Strassburg and Manns, 2006)***.

Definitive characterization by magnetic resonance (MR) imaging may alleviate patient anxiety, drastically alter management in someone, and help avoid unnecessary biopsy or costly follow-up imaging. MR imaging offers important advantages over computed tomography (CT), such as the lack of ionizing radiation and improved soft tissue contrast ***(Cogley and Miller, 2014)***.

MRI can be used as the primary imaging examination for patients who cannot receive iodinated IV contrast material and patients in whom the liver is the only organ of concern. MRI is useful as a problem solving technique when other imaging studies show equivocal findings ***(Lee et al., 2006)***.

The American College of Radiology Appropriateness Criteria assigns the highest rating to MR imaging without and with contrast for characterization of indeterminate liver lesions, regardless of whether the patient is otherwise healthy, has liver disease, or has a known extra hepatic malignancy ***(Nelson et al., 2014).***

With the current state of the art technology, magnets of 1.5 Tesla (T) and 3T field strength are considered the standard of reference in providing high-quality and consistent MR images. Giant advances in MRI have been achieved in the last decade in regards to each of the

following: hardware (high-performance gradient coils and phased-array surface coils), software (new sequence design and new parallel imaging technology and acceleration techniques), and contrast agents (hepatocyte-specific agents) have made a major impact on imaging of the liver ***(Ramalho et al., 2007).***

The state of the art MRI protocols rely on a combination of fat-suppressed and non-fat-suppressed T2-weighted images (T2-WI), in- and opposed-phase (IP/OP) T1-WI and dynamic pre- and post-contrast fat-suppressed T1-WI ***(Fowler, Brown and Narra, 2011).***

The detection and characterization of focal hepatic lesions continues to be a challenge. 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 ***(Rofsky et al., 1999).***

Contrast-enhanced 3D GRE MR imaging 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, pseudocentral scar, and pseudocapsule ***(Hamm et al., 1994).***

Recently, diffusion-weighted imaging (DWI) sequences have been shown to be an emerging contributor for liver MRI and are being incorporated in most abdominal MR protocols ***(Galea, Cantisani and Taouli, 2013).***

The underlying principle is that different biologic tissues exhibit varying levels of restricted water diffusion, dependent on such factors as tissue cellularity and cell membrane integrity ***(Koh and Collins, 2007).***

Aim of the Work

The aim of this work is to study the role of MRI in characterization of benign hepatic focal lesions.