Role of Diffusion Weighted Imaging in Assessment of Primary Malignant Lesion in the liver

Thesis
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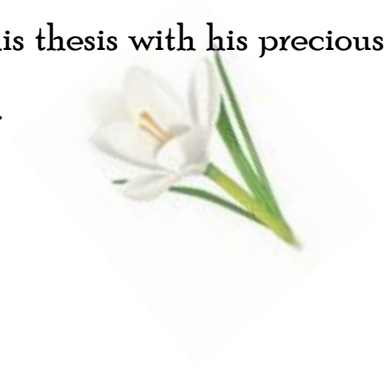

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List of Abbreviations

3D = three dimensional.
ADC= apparent diffusion coefficient.
APA= arterio-portal anastomoses.
BH= breath hold.
CCA = cholangiocellular carcinoma.
CT = computed tomography.
CV= central venule.
DW MRI= diffusion weighted magnetic resonance imaging.
DWI= diffusion weighted imaging.
EHE= epithelioid heamangioendothelioma.
EPI= echo planner imaging.
FFE= fast field echo.
Fig= figure.
FLC= fibrolamellar carcinoma.
FLL= focal liver lesions.
FNH= focal nodular hyperplasia.
FOV=Field of view
FS= fast spin.
FSE = fast spin echo.
GB= gall bladder.
Gd = gadolinium.
Gd DTPA= gadolinium diethylenetriamine pentaacetic acid (hepatocyte-specific contrast agent taken by hepatocytes and excreted into biliary system).
GI= gastrointestinal.
GRAPPA= generalized auto- calibrating partially parallel acquisition.
GRE= gradient recalled echo.
H& E= hematoxylin and eosin
HA= hepatic artery.
HAP=Hepatic arterial phase

HCC= hepatocellular carcinoma.
HCV= hepatitis C virus.
HMS= hepatic microvascular subunits.
ICAC=Intra hepatic cholangiocarcinoma
IHE=Infantile haemangio endothelioma
IVC = inferior vena cava.
min= minute.
MPGs=Motion probing gradients
MR= magnetic resonance.
MRI = magnetic resonance imaging.
msec= millisecond.
NEX= number of excitations.
PSC= Primary sclerosing cholangitis.
PV= portal vein.
PVP=Portal venous phase
RF=Radiofrequency
RT= respiratory triggered.
SE= spin echo.
sec= second.
SGE= spoiled gradient echo
SI= signal intensity.
SNR=signal to noise ratio.
SOR= standard of reference.
SPAIR = spectral attenuated inversion recovery (fat suppression MRI technique).
SSFSE=Single shot fast spin echo
T= tesla.
TE= echo time.
THRIVE= high resolution isotropic volume examination.
TR= repetition time.
TSE= turbo spin echo.
US= ultrasonography.
VIBE= volumetric interpolated breath hold examination.
WIs= weighted images.

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INTRODUCTION

Accurate detection and characterization of focal liver lesions such as hepatocellular carcinoma (HCC) is important for treatment planning. The size and number of lesions can affect therapy. For example, patients with limited resectable metastatic lesions may benefit from curative resection, and patients with fewer than three small HCCs are candidates for liver transplantation. Patients with more extensive disease should instead undergo transarterial chemoembolization, radiofrequency ablation, or systemic chemotherapy ***(Heslin et al., 2001).***

Focal liver lesions are diagnosed using ultrasonography (US) and/or computed tomography (CT). Additionally, magnetic resonance imaging (MRI) is preferred when further characterization of these masses is needed. MRI has many advantages (e.g., high contrast resolution, the ability to obtain images in any plane, lack of ionizing radiation, and the safety of using particulate contrast media rather than those containing iodine) that make it a favored modality ***(Semelka et al, 1992).***

Focal nodular lesions characterization with Magnetic resonance imaging (MRI) is based on their morphology, signal intensity on different sequences (HASTE, T1) and on their behaviour with paramagnetic contrast agents (Gadolinium). Specific contrast agents have also been used, but due to their high cost they are not commercially available. However, even with

regular protocol studies, including above mentioned sequences, there are still lesions where an accurate differentiation between benign and malignant lesions is not always achieved ***(Vergara et al, 2010).***

Diffusion is the term used for the randomized microscopic movement of water molecules known as Brownian motion. Diffusion is known to be a sensitive parameter in microscopic tissue characterization ***(Namimoto et al, 1997).***

Diffusion-weighted MR imaging (DWI), theoretically described as far back as the 1950s and 1960s by ***Carr and Purcell (1954)*** and ***Stejskal and Tanner (1965),*** has become an established method in neuroradiology since the introduction of the intravoxel incoherent motion technique by ***Le Bihan et al (1988).***

DWI examinations have many technical restrictions such as respiratory, cardiac, or peristaltic physiologic activity, all of which affect image quality and make evaluation, which is very sensitive to motion, more difficult. Consequently, prior to the development of fast MRI techniques, DWI was limited to cranial examinations. With the development of echo-planar imaging (EPI), a fast MRI technique, radiologists have overcome the long imaging times and related artifacts of conventional techniques, and DWI is now available for abdominal evaluations as well ***(Coenegrachts et al, 2007).***

DW-MRI can help characterize focal hepatic lesions by enabling measurement of lesion apparent diffusion coefficient (ADC) ***(Parikh et al, 2008).***

DW imaging could potentially improve care of patients with cancer and cirrhosis by improving liver lesion detection over that achieved with standard breath-hold T2-weighted imaging ***(Parikh et al, 2008).***

Diffusion weighted technique should be used as an additional sequence to supplement conventional MRI protocol studies for proper characterization of focal liver lesions ***(Vergara et al, 2010).***

AIM OF WORK

The aim of this study is to show the growing and useful role of DW-MRI in the characterization of hepatic focal lesions for better patient management plan.