Role of Diffusion-weighted Magnetic Resonance Imaging in evaluation of malignant hepatic focal lesions

Essay

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Summary and Conclusion

Malignant liver tumors including primary liver cancers and metastases are among the most common tumors in the world.

Accurate detection of these tumors is of clinical importance before treatment by resection or radiofrequency ablation as a potential curative treatment. Palliative interventions such as chemo-embolization also require exact lesion localization. Accurate detection is necessary to ensure correct staging, to prevent tumors from being falsely rated as inoperable and patients with inoperable tumors from being scheduled for surgical procedures.

Triphasic CT was believed to be the standard in evaluating the hepatic focal lesions and together with alpha fetoprotein, the lesions were decided either non conclusive and needing biopsy or conclusive. According to number and distribution of the lesions (if proved or malignant); surgery, radiofrequency ablation or chemo chemoembolization was decided. Unfortunately, not all cases with HCC having high alpha fetoprotein and not all cases having typical imaging criteria of HCC and also, not all lesions detected by US are seen in the dynamic CT study.

MRI; having many sequences; markedly helps in the detection of small lesions and in reaching the diagnosis easily even without contrast injection.

Diffusion-weighted imaging (DWI) has been reported to be useful for the early detection of focal liver lesions. Moreover, DWI offers the possibility to obtain criteria for lesion characterization-

Introduction

The liver is an organ in which various malignant primary or secondary masses can be detected. Today, hepatic focal masses 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 ***(Demir et al., 2007).***

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. Lesion morphology, signal intensity, and contrast enhancement pattern are taken into consideration when characterizing masses with MRI; however, even if the data are evaluated together, there can still be difficulties in the differentiation of benign and malignant lesions ***(Demir et al., 2007).***

There has been significant progress in hepatic MRI in the last 10 years that increased interest and ability to evaluate focal hepatic masses by quantifying parameters such as diffusion ***(Glockner, 2007).***

With recent advances in technology, Diffusion-weighted magnetic resonance imaging (DWMRI) is a new technique of magnetic resonance imaging (MRI) at the level of molecular movements and can reflect the functions and structures of the tissue without trauma ***(Sun et al., 2005).***

Diffusion-weighted magnetic resonance imaging (DWMRI) is reaching a potential for clinical use in the abdomen, particularly in the liver. DW MR imaging is an attractive technique for multiple reasons: it can potentially add useful qualitative and quantitative information to conventional imaging sequences; it is quick (performed within a breath hold) and can be easily incorporated to existing protocols; and it is a non-enhanced technique (performed without the use of gadolinium-based contrast media), thus easy to repeat, and useful in patients with severe renal dysfunction at risk for nephrogenic systemic fibrosis ***(Thomsen et al., 2008).***

Aim of the work:

The aim of this study is to highlight the value of Diffusion-weighted Magnetic Resonance Imaging in differential diagnosis of malignant hepatic focal lesions.

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List of Abbreviations

Abbreviation	**Meaning**
ADC	Apparent Diffusion Co-efficient
ASR	Ablation site recurrence
BH	Breath-hold
CCC	Cholangiocarcinoma
CT	Computed Tomography
DWI	Diffusion-weighted Imaging
EPI	Echo planar Imaging
FIRM	Fast Inversion-Recovery Motion- insensitive
FLC	Fibrolamellar carcinoma
FLL	Focal liver lesion
FOV	Field of View
Gd-DTPA	Gadolinium diethyl-enetriamine penta-acetic acid
GRE	Gradient Echo
HBV	Hepatitis B virus
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus

IVC	Inferior vena cava
LHV	Left hepatic vein
MHV	Middle hepatic vein
MnDPDP	Mangafodipir trisodium
MPGs	Motion probing gradients
MP-RAGE	Magnetization prepared rapid acquisition Gradient Echo
MRA	Magnetic Resonance Angiography
MRI	Magnetic Resonance Imaging
N	Number
NHL	Non-Hodgkin's lymphoma
NPV	Negative predictive value
PPV	Positive predictive value
PSA	Periodic Acid Schiff
RARE	Rapid acquisition with relaxation enhancement
RF	Radio-frequency
RFA	Radio-frequency ablation
RHV	Right hepatic vein
ROC	Receiver Operator Characteristic Analysis

RT	Respiratory-triggered
SE	Spin Echo
SGE	Spoiled Gradient Echo
SNR	Signal-to-noise ratio
SPIO	Super Paramagnetic Iron Oxide
T	Tesla
TACE	Trans-catheter Arterial Chemo-embolization
TE	Time to Echo
TR	Time to Repeat
Turbo FLASH	Turbo-Fast Low Angle Shot
VIBE	Volumetric Interpolated Breath-hold Examination
US	Ultrasonography