CHARACTERIZATION OF HEPATIC FOCAL LESIONS USING MRI WITH NEW CONTRAST MATERIALS

Essay

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LIST OF ABBREVIATIONS

NRH	Nodular regenerative hyperplasia
FNH	Focal Nodular Hyperplasia
HA	Hepatocellular Adenoma
HCC	Hepatocellular carcinoma
FHCC	Fibrolamellar Variant of HCC
IHE	Infantile Hemangioendothelioma
AML	Angiomyolipoma
EHE	Epithelioid hemangioendothelioma
HB	Hepatoblastoma
IPT	Inflammatory Pseudotumor
SE	Spin echo sequence
GRE	Gradient recalled echo sequence
FOV	Field of View
STIR	Short T1 inversion recovery
FLAIR	Fluid attenuated inversion recovery
MAST	Motion artifact suppression technique
FLASH	Fast Low-Angle Shot
GRASS	Gradient-Recalled Acquisition in the steady state
HASTE	Half Fourier Acquisition Single Shot Turbo Spin Echo
VIBE	Volumetric Interpolated Breath-Hold Examination
FIRM	Fast inversion-recovery motion-insensitive
DWI	Diffusion-weighted Imaging
SENSE	Sensitivity Encoding
SMASH	Simultaneous Acquisition of Spatial Harmonics
Gd-DTPA	Gadopentate dimeglumine
Gd-DTPA-BMA	Gadodiamide
Gd-DOTA	Gadoterate meglumine
Gd-HP-DO3A	Gadoteridol
Gd-BOPTA	Gadobenate dimeglumine
Gd-EOB-DTPA	Gadoxetic acid(Gadolinium- ethoxybenzyl-diethylenetriaminepentaacetic acid)
Mn-DPDP	Mangafodipir trisodium
CMC-001	Copenhagen Malmö Contrast
SPIO	Superparamagnetic iron oxide
USPIO	Ultrasmall superparamagnetic iron oxide
VSOP-C184	Very small SPIO particle, citrate coating, 184th formulation

CONTENTS

INTRODUCTION

The liver is the largest of the abdominal viscera, occupying a substantial portion of the upper abdominal cavity. It performs a wide range of metabolic activities necessary for homeostasis, nutrition and immune defense. ***(Standring et al., 2005)***.

Hepatic focal lesions constitute a daily challenge in the clinical settings. However, noninvasive methods can be useful in the detection and characterization of these lesions. The noninvasive diagnosis of liver lesions is usually achieved with contrast material-enhanced computed tomography and magnetic resonance (MR) imaging. Dynamic three-dimensional gradient-recalled-echo MR imaging provides dynamic contrast-enhanced thin-section images with fat saturation and a high signal-to-noise ratio and is excellent for the evaluation of various focal hepatic lesions ***(Elsayes et al., 2005)***

Metastases are the most common malignant liver lesions and the most common indication for hepatic imaging. Specific characterization of liver metastases in patients with primary non-hepatic tumors is crucial to avoid unnecessary diagnostic work-up for incidental benign liver lesions. Magnetic resonance (MR) is rapidly emerging as the imaging modality of choice for detection and characterization of liver lesions due to the high specificity resulting from optimal lesion-to-liver contrast. ***(Elsayes et al., 2005)***.

With the recent advances in MR contrast agents, MR may replace computed tomographic arterial portography. MR imaging has several advantages over CT such as no risks from radiation exposure and no adverse reactions to iodinated contrast agents. Indeed, MR is rapidly evolving as the primary imaging modality for the detection and characterization of liver lesions including metastases ***(Ward et al., 2006)***

The ideal contrast agent for liver MR examinations must have a strong magnetic effect, little if any side effects and biodistribution differentiation. ***(Reimer et al., 2004)***

There are two classes of MRI contrast agent available commercially to image the liver: **liver-specific** and **liver-nonspecific contrast agents**. The liver-specific agents are divided into two groups: hepatocyte-selective and reticuloendothelial-specific contrast agents. Reticuloendothelial-specific agents are ferumoxides and ferucarbotran; hepatocyte-specific agents are gadobenate dimeglumine and gadoxetic acid. The nonspecific contrast agents are Gd-chelates, such as Gd-DTPA-BMA and Gd-DTPA ***(Huppertz et al., 2005).***

AIM OF THE WORK

The aim of this work is to evaluate the role of contrast enhanced MRI in detection and characterization of hepatic focal lesions regarding its advantages over other modalities used in liver imaging using new contrast agents, so allow early and appropriate management of liver tumors.

Anatomy of the Liver

The liver is a vital organ as it has a wide range of functions, including detoxification, protein synthesis, and production of biochemicals necessary for digestion. The liver is necessary for survival; there is currently no way to compensate for the absence of liver function. ***(Maton et al., 1999)***

Position and shape:

The liver is located in the upper right-hand portion of the abdominal cavity beneath the diaphragm and on top of the stomach, right kidney, and intestines. It extends from the right lateral aspect of the abdomen 15 to 20 cm transversely toward the xiphoid. ***(Standring et al., 2005)***.

Fixation of the liver:

Several factors contribute to maintain the liver in place. The attachments of the liver to the diaphragm by the coronary and triangular ligaments and the intervening connective tissue of the uncovered area would hold up the posterior part of the liver. ***(Standring et al., 2005)***

External features

Peritoneal attachments to the liver:

The liver is connected to the under surface of the diaphragm and to the anterior wall of the abdomen by five ligaments. **(Fig. 1)**

The falciform ligament

It is a broad and thin antero-posterior peritoneal fold. It is attached by its left margin to the under surface of the diaphragm, and the posterior surface of the right Rectus sheath; by its right margin it extends from the notch on the anterior margin of the liver to the posterior surface. ***(Standring et al., 2005)*** .

The coronary ligament

It consists of an upper and a lower layer. The upper layer is formed by the reflection of the peritoneum from the upper margin of the bare area to the under surface of the diaphragm. The lower layer is reflected from the lower margin of the bare area on to the right kidney and suprarenal gland ***(Standring et al., 2005).***

The triangular ligaments

The **right triangular ligament** is situated at the right extremity of the bare area. It is formed by the opposition of the upper and lower layers of the coronary ligament. The **left**

triangular ligament connects the posterior part of the upper surface of the left lobe to the diaphragm. ***(Standring et al., 2005)***.

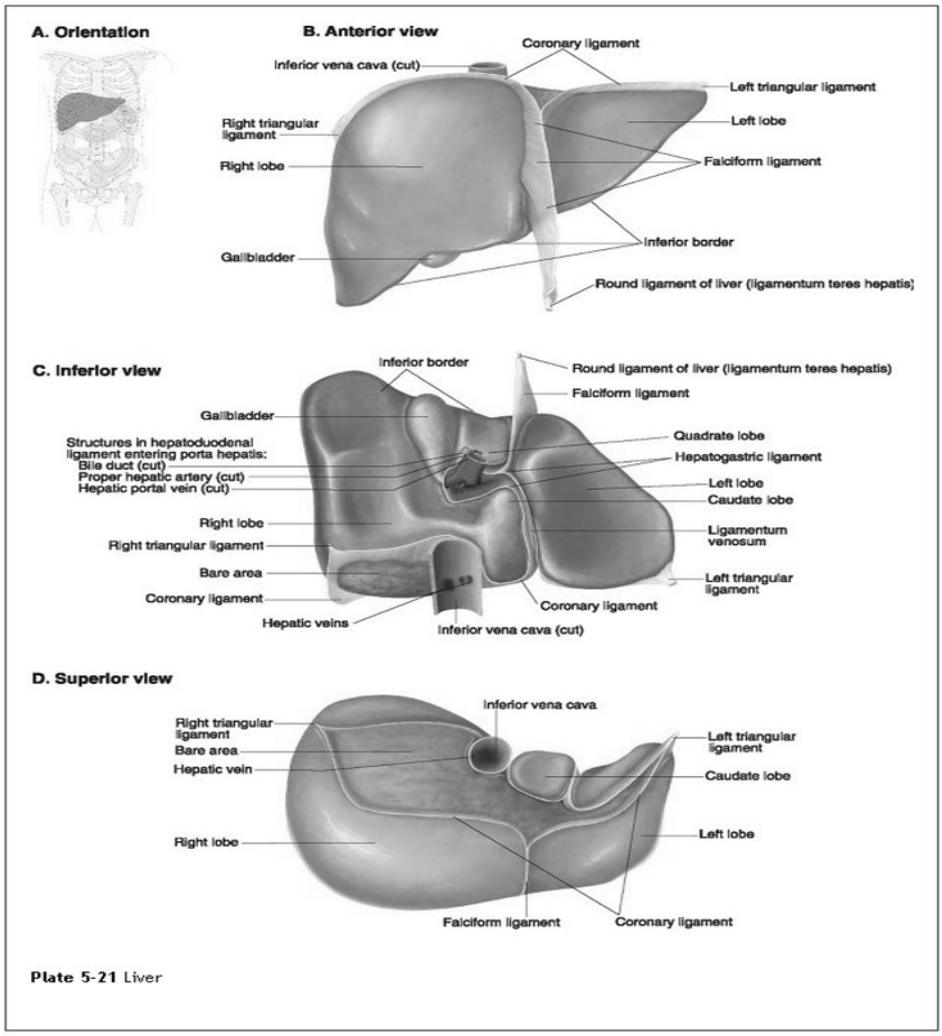

Figure (1): External features of the liver ***(Lippincott Williams & Wilkins Atlas of Anatomy, 1st Edition. 2008)***.