Role of MRI in Evaluation of Hepatic Steatosis

Essay

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List of Abbreviations

Abbrev.	Full term
ALD	: Alcoholic liver disease
Ao	: Aorta
CA	: Celiac artery
CSI	: Chemical shift imaging
FIESTA	: Fast imaging with steady state acquisition
FISP	: Fast imaging with steady-state precession
GDA	: Gastroduodenal artery
GRE	: Gradient-echo
HCC	: Hepatocellular carcinoma
HL	: Hepatic lipidosis
HS	: Hepatic steatosis
HTGC	: Hepatic triglycride content
HV	: Hepatic vein
IMV	: Inferior mesenteric vein
IP	: In -phase
IVC	: Inferior vena cava
LFC	: Liver fat content
MRI	: Magnetic resonance imaging
MRS	: Magnetic resonance spectroscopy
NAFLD	: Non-alcoholic fatty liver disease
NASH	: Nonalcoholic steatohepatitis
OP	: Opposed phase
PPP	: Parts per million
PRESS	: Point- resolved spectroscopy

List of Abbreviations (Cont.)

Abbrev.	Full term
PV	: Portal vein
ROI	: Region of interest
SI	: Signal intensity
SMA	: Superior mesenteric artery
SMV	: Superior mesenteric vein
SNR	: Signal-to-noise ratio
STEAM	: Stimulated echo acquisition mode
SVS	: Single voxel spectroscopy
T	: Tesla
TE	: The echo time
TR	: The repetition time

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Introduction

Liver steatosis, defined as the accumulation of more than 5% fat in the liver, is the hallmark of most prevalent liver diseases, mainly alcoholic and nonalcoholic fatty liver disease (NAFLD). It is also highly prevalent in chronic hepatitis C virus (HCV) infection ***(Webb et al., 2009)***.

Because of a variety of factors, including the use of both widely variable and subjective diagnostic criteria, the reported prevalence of hepatic steatosis has ranged from 3% to 39% in the literature ***(Boyce et al., 2010).***

The adverse prognostic implications of liver steatosis for living liver donors and for patients undergoing liver resection are increasingly being recognized, highlighting the need for a noninvasive method of detecting and quantifying liver fat in these patients ***(Cassidy et al., 2009).***

Percutaneous liver biopsy is the current standard means of diagnosing and grading steatosis, but it is an invasive procedure with potentially serious complications including hemorrhage, infection, bile leak, and a mortality of up to 0.3% ***(Qayyum et al., 2009).***

The lack of a safe, inexpensive and non-invasive method for accurate identification and quantitative grading of NAFLD has been a major barrier to understanding its epidemiology and pathophysiology. Therefore, there has been recent interest in the development of noninvasive MRI methods for the detection and quantification of fatty liver ***(Reeder et al., 2009).***

Early diagnosis and early treatment of NAFLD are important to prevent the development of endstage liver disease and cancer. In addition, liver fat is a risk factor for postoperative complications after liver resection and transplantation. MRI has become a primary modality to assess hepatic steatosis, both qualitatively and quantitatively MR imaging is a very sensitive and specific noninvasive modality for detection of hepatic steatosis. Chemical shift images are an efficient method for screening, diagnosis and semiquantification of liver steatosis ***(Gangadhar et al., 2014).***

Dual-echo, gradient-echo in-phase and opposed-phase MRI can predict the degree of hepatic steatosis when it is mild to moderate, and may obviate the need for liver biopsy for the purpose of quantification of steatosis in living donors ***(Rinella et al., 2003).***

More recently, proton magnetic resonance spectroscopy (1H MRS) has been shown to be a fast, safe, non-invasive method for the relative quantification of intrahepatocellular lipid (IHCL) content. This imaging modality should enable the true significance of IHCL accumulation in the pathogenesis of conditions such as insulin resistance and type II diabetes to be understood ***(Thomas et al., 2005).***

These techniques permit the breakdown of the net MR signal into fat and water signal components, allowing the quantification of fat in liver tissue, and are increasingly being used in the diagnosis, treatment, and follow-up of fatty liver disease ***(Cassidy et al., 2009).***

In contrast to other modalities such as ultrasound and computed tomography (CT), MRI/MRS are capable of detecting even small amounts of intrahepatic lipid accumulation. Therefore, MRI/MRS are especially useful to measure changes in hepatic steatosis during various treatment regimens ***(Springer et al., 2010).***

Aim of the Work

The aim of this study is to shed some lights on the importance of magnetic resonance imaging in evaluation of hepatic steatosis and to explore the new MR strategies that provide an accurate, non invasive and more rapid means of assessing hepatic fat content, aiming to early diagnosis and treatment of fatty liver disease and hence preventing the potential development of cirrhosis and hepatocellular carcinoma (HCC).

Chapter (1)
Gross Anatomy of the Liver

The liver, the largest organ in the body, is found in the right upper quadrant of the abdomen. It is relatively much larger in the fetus and child. The liver assumes the shape of the cavity it occupies. It has two surfaces, the diaphragmatic surface and the visceral surface.

The anatomy of the liver according to its external appearance identifies a superior or diaphragmatic surface and an inferior or ventral surface. On the superior aspect, the falciform ligament separates the liver into a larger right lobe and a smaller left lobe (Fig. 1). The inferior surface is more varied; the round ligament continues into with the umbilical portion of the left portal vein (Fig. 2) ***(Majno et al., 2002).***

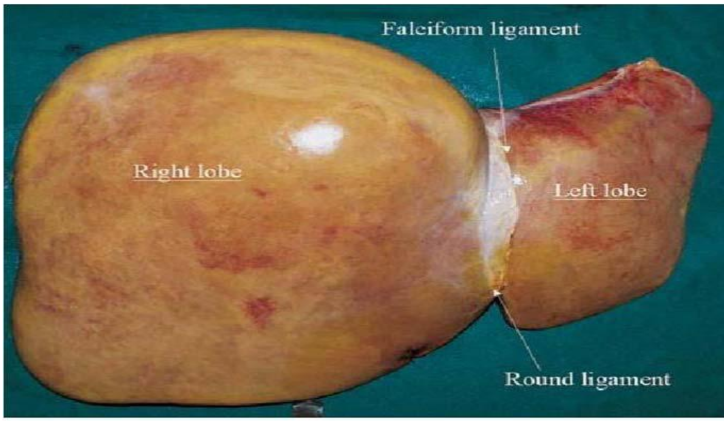

Figure (1): Superior (Diaphragmatic surface of the liver) Quoted from ***Majno et al. (2002).***