Role of Dynamic Subtraction MRI in Detection of Hepatocellular Carcinoma

An Essay

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By

Asmaa Abd Elmonem Elnehrawy
M.B., B.Ch.,

Supervised by

Prof. Dr. *Aida Mohamed Elshibiny*
Professor of Radiodiagnosis
Faculty of Medicine
Ain Shams University

Assist. Prof. Dr. *Ahmed Ghandour*
Assistant Professor of Radiodiagnosis
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
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أسماء عبد المنعم النحراوي

تحت إشراف

أ.د / عايدة محمد الشبينى
أستاذ الأشعة التشخيصية
كلية الطب – جامعة عين شمس

أ.م.د / أحمد غندور
أستاذ مساعد الأشعة التشخيصية
كلية الطب – جامعة عين شمس

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Contents

List of Abbreviations

AJCC	American Joint Committee on Cancer
AO	Aorta
CM	Contrast media
CT	Computed tomography
EHE	Epithelioid hemangioendothelioma
FNH	Focal nodular hyperplasia
FRFSE	Fast recovery fast spin-echo
FSE	Fast spin echo
GDA	Gastro duodenal artery
HBV	Hepatitis B virus
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus
HIV	Human immune deficiency virus
HV	Hepatic vein
IMV	Inferior mesenteric vein
IVC	Inferior Vena Cava
MRI	Magnetic Resonance Imaging
SGE	Spoild gradient echo
SMV	Superior mesenteric vein
SPIO	Superparamagnetic iron oxide
STIR	Short tau inversion recovery
T	Tesla
TE	Time to echo
TR	Time of repetition
UICC	International Union Against Cancer
US	Ultrasound

List of Table

List of Figures

Introduction

Cirrhosis is a diffuse liver disease characterized by progressive paranchymal damage and nodular regeneration. Hepatocellular carcinoma (HCC) is a neoplasm that usually arises in a cirrhotic liver by a multisteps carcinogenesis process ***(Brancatelli et al 2007)***.

Recent studies have shown that in patient with cirrhosis and early stage HCC, liver transplantation offers the best chance for long-term survival. Therefore, early detection of HCC and accurate assessment of tumour burden are crucial to successful treatment planning and long-term survival ***(Secil et al 2008).***

Ultrasonography is the primary screening test since it allows for a quick and cost-effective way to examine the liver parenchyma and can be done as frequently as needed, typically every 3-6 months ***(Nicolau et al 2002).***

However, US based screening for HCC has a suboptimal sensitivity and specificity, especially when liver cirrhosis is present. Hence patients with an abnormal liver US showing cirrhosis or focal mass often undergo a contrast-enhanced CT or MRI examination ***(Vogl et al 2002).***

Magnetic resonance imaging (MRI) is extremely useful in the detection and characterization of regenerating and dysplastic nodules and HCC. Several studies have demonstrated the superiority of MRI in both lesions when compared to CT ***(Semelka et al 2001)***.

Gadolinium-enhanced MRI with multiple phases of acquisiation improves the detection of HCC. However, the determination of contrast enhancement is not always easy to accomplish for hyperintense lesions on arterial phase dynamic image. Subtraction of unenhanced image from gadolinium-enhanced images has been pursued in an attempt to maximize the qualitative recognition of lesion enhancement ***(Yu and Rofsky 2003).***

The use of dynamic subtraction MRI is a simple automatic procedure that is commonly available in most MRI machines and the use of subtraction of dynamic contrast enhanced series is a helpful in detection of HCC and yielded increased sensitivity, specificity and accuracy rates compared to the use of the standard protocol alone ***(Secil et al 2008).***

Magnetic resonance imaging (MRI) has, in recent years, led to significantly better detection of hepatic focal lesions following improvements in technology and techniques ***(Arguedas 2003).***

Aim of the Work

The aim of this study is to demonstrate the role of MRI using new technique of dynamic subtraction for early detection and characterization of HCC.

A. Gross Anatomy of the Liver

The liver is the largest gland in the body and has a wide variety of functions ***(Snell 2004).***

The liver is soft and pliable and occupies the upper part of abdominal cavity just beneath the diaphragm ***(Snell 2004).***

Surfaces of the liver

The diaphragmatic or upper surface

Is smooth, flat posteriorly and has a round upper surface with a large dome for the right hemi-diaphragm and a smaller dome for the left hemi-diaphragm. A depression between these marks the site of the central tendon and the overlying heart. The diaphragmatic surface ends anteriorly in the inferior surface of the liver. The inferior border ascends less obliquely than the costal margin and lies below it as it crosses the midline to meet the costal margin of the left side at approximately the eight costal cartilage ***(Ryan 1994).***

In addition to the notch for the gall bladder, the inferior border is marked by notch for ligamentum teres which is the obliterated remnant part of the left umbilical vein, and passes with small paraumbilical veins from the

umbilicus to the inferior border of the liver in the free edge of a crescentric fold of peritoneum called the falciform ligament, this meets the liver just to the right of the midline, this site is used as an anterior marker of the sagittal plane of division of the liver into anatomical right and left lobes ***(Fig.1) (Ryan 1994).***

The posterior or visceral surface

It is marked by H-shaped arrangement of structures. The crossbar is made by hilum of the liver (porta hepatis). This is the site for entry of right and left hepatic arteries, portal veins and exit for the right and left hepatic ducts and passage of autonomic nerves and lymph vessels. The gall bladder and the inferior vena cava form the right vertical part. These are separated by the caudate process, which connects the caudate lobe with the right lobe of the liver. The left vertical part is formed by ligamentum teres. This is continuous with the fissure for ligamentum venosum ***(Fig.2) (Ryan 1994).***

The visceral surface of the liver is in contact with

- The oesophagus, stomach and lesser omentum on the left side.
- The pancreas and the duodenum in the midline.
- The right kidney, adrenal gland and hepatic flexure of the colon on the right side ***(Ryan 1994).***