Can diffusion MRI change the management of HCC patient with portal vein thrombosis: differentiation between bland and malignant portal vein thrombosis

Thesis

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Dedication

To my parents,
For
Their never-ending support.

To my brother and my friends,
For
Their love and encouragement.

Ahmed

Acknowledgement

*First and foremost, thanks to **Allah**, the most beneficent and most merciful.*

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Abstract

Neoplastic portal vein thrombi in patients with HCC gravely affect the prognosis and the subsequent treatment options.

Diffusion weighted imaging is an MR technology that measures the diffusion of water molecules in the tissue. So characterization of tissue is enabled; in malignant tissue, the diffusion of water molecule is restricted and so lower ADC values are noted as compared to benign lesions.

Therefore, to determine the role of DW image in differentiation between the malignant and bland portal vein thrombosis, we studied the ADC values and ratios in 74 patients; 55 patients have HCC with malignant portal vein thrombosis and 19 patients have HCC with bland portal vein thrombosis.

We found that the ADC ratio was significantly different between the neoplastic and bland cohorts with a cutoff value = 1.2 mm 2 /sec helped distinguish between the neoplastic and bland portal vein thrombi. While there is no statistically significant difference between the ADC values of the thrombi in the neoplastic and bland cohorts.

So the DW image can help in differentiation between the malignant and bland portal vein thrombosis through measuring the ADC ratio.

Key words: DW image, portal vein thrombosis, HCC.

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List of abbreviations

ADC	**Apparent Diffusion Coefficient**
AFP	**Alfa Feto Protein**
CT	**Computed Tomography**
DW	**Diffusion Weighted**
FNB	**Fine Needle Biopsy**
FOV	**Field Of View**
Gd-DTPA	**Gadolinium Diethylenetriamine Penta-Acetic**
HCC	**Hepatocellular Carcinoma**
LPV	**Left Portal Vein**
MR	**Magnetic Resonance**
MPV	**Main Portal Vein**
OATP	**Organic Anionic Transporting Polypeptides**
PC	**Prothrombin Concentration**
PS	**Prothrombin Saturation**
PVT	**Portal Vein Thrombosis**
RAPV	**Right Anterior Portal Vein**
ROI	**Region Of Interest**
RPPV	**Right Posterior Portal Vein**
RPV	**Right Portal Vein**
SE	**Spin-Echo**
SMV	**Superior Mesenteric Vein**
SPAIR	**Spectral Selection Attenuated Inversion Recovery**
SV	**Splenic Vein**
THRIVE	**T1 Weighted High-Resolution Isotropic Volume Examination**
TFE	**Turbo Field Echo**

TSE	**Turbo Spin Echo**
US	**Ultrasound**
3D GRE	**3 Dimension Gradient Echo**

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Introduction

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Aim of work

Introduction

Hepatocellular carcinoma (HCC) is the fifth most common tumor in the world, and its incidence is increasing, especially in Western nations **(Choi JY et al., 2014).**

HCC may be associated with portal vein thrombosis which could be either bland or malignant **(Choi JY et al., 2014).**

Neoplastic portal vein thrombi in patients with HCC gravely affect the prognosis and the subsequent treatment options. These patients are considered unsuitable for most of the therapeutic options **(Catalano OA et al., 2010).**

Although the reference standard in the diagnosis of the malignant portal vein thrombosis is the pathologic examination, in clinical practice, diagnostic imaging plays a pivotal role; demonstration of arterial flow within the thrombus by using spectral Doppler US is 100% specific for tumor thrombus. Also, contrast-enhanced US has been demonstrated to be 88% sensitive and 100% specific in the diagnosis of malignant portal vein thrombosis **(Tarantino L et al., 2006).**These figures are similar to those obtained at contrast-enhanced CT, with a sensitivity of 86% and a specificity of 100 % **(Shah ZK et al., 2010).**

DW imaging is an MR technology that measures the diffusion of water molecules in the tissue. Therefore characterization of tissue is enabled; in malignant tissue, the diffusion of water molecule is restricted, so lower ADC values are noted as compared to benign lesions. Also, DW imaging does not require contrast medium

administration, therefore it can be safely done in patients with contraindications to contrast media **(Catalano OA et al., 2010).**

Aim of work

To determine the role of DW imaging in differentiating between the benign and malignant portal vein thrombosis in patient with HCC.

Chapter one

Embryology and anatomy of the portal vein

1. Embryological development

The development of the portal venous system occur between the 4th and 12th weeks of gestation .It results from a complex process that includes selective persistence of parts of the vitelline venous system and communication with the umbilical venous system around the developing liver (Fig.1) **(Lee WK et al., 2011).**

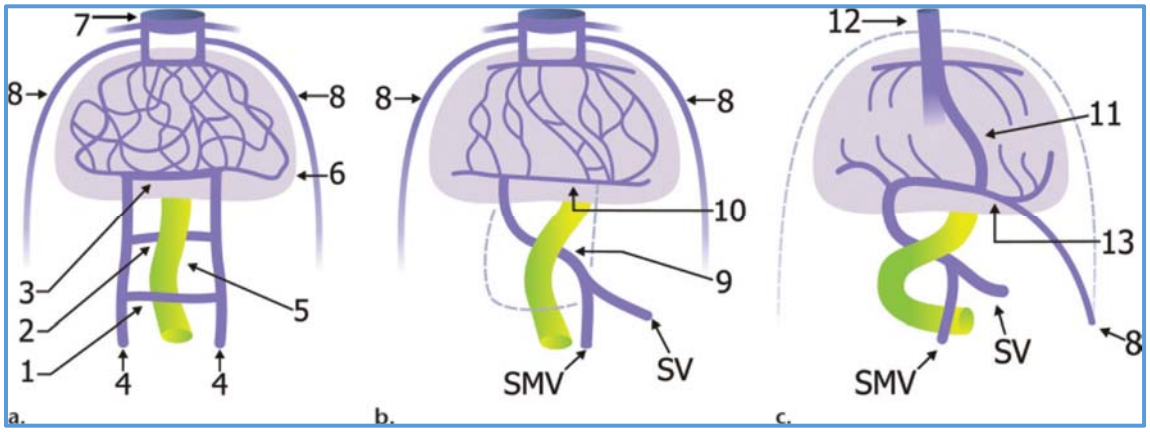

Figure 1. Drawings illustrate the embryologic development of the portal venous system. **(a)** Initially, the caudal-ventral (1), dorsal (2), and cranial-ventral (3) anastomoses develop from the paired vitelline veins (4) around the duodenum (5). They pierce the septum transversum (6), forming multiple sinusoids, and drain into the sinus venosus (7). The paired umbilical veins (8) also drain into the sinus venosus. **(b)** In the next stage, involution of parts of the vitelline veins and caudal-ventral anastomosis (dashed line) occurs. The dorsal anastomosis becomes the portal vein (9), and the cranial-ventral anastomosis becomes the left portal vein (10). **(c)** Next, the right umbilical vein and cranial portion of the left umbilical vein involute (dashed line). The ductus venosus (11) forms between the caudal left umbilical vein (8) and the inferior vena cava (12). Last, a new communication forms between the left umbilical vein and the left portal vein (13). SMV = superior mesenteric vein, SV = splenic vein **(Lee WK et al., 2011).**