

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 mm²/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.

Table of content

List of abbreviations	I-II
List of tables	III
List of figures	IV-V
Introduction & Aim of work	1-2
Ch.1 Embryology & Anatomy of portal vein	3-10
Ch.2 Diffusion weighted imaging : Concepts and principles	11-27
Ch.3 Etiology and pathophysiology of portal vein thrombosis	28-32
Ch.4 Development, growth and spread of hepatocellular carcinoma	33-47
Ch.5 CT and MRI appearance of HCC and its nodules precursors	48-64
Ch.6 Multimodality imaging of portal vein thrombosis	65-74
Patients and methods	75-80
Cases	81-86
Results	87-99
Discussion	100-105
Summary and conclusion	106-107
References	108-116
Arabic summary	

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

List of tables

		Page
Table 1.	Local risk factors for PVT	30
Table 2.	Systemic risk factors for PVT	32
Table 3.	CT and MR imaging appearance of HCC precursor nodules	48
Table 4.	Cases of HCC with malignant portal vein thrombosis.	88 & 89
Table 5.	Cases of HCC with bland portal vein thrombosis.	90
Table 6.	ADC measurement of HCC cases with malignant portal vein thrombosis.	91 & 92
Table 7.	ADC measurement of HCC cases with bland portal vein thrombosis.	93
Table 8.	Mean and standard deviation of ADC measurement	95
Table 9.	Independent Samples Test.	96

List of figures

		Page
Figure 1.	Embryologic development of the portal venous system.	3
Figure 2.	Normal portal vein anatomy	5
Figure 3.	Segmental hepatic anatomy	6
Figure 4.	Posterior branch of the right portal vein variant	8
Figure 5.	Trifurcation of the main portal vein	8
Figure 6.	Proximal origin of segment VII vein	9
Figure 7.	Segment VI portal vein variant	9
Figure 8.	Water molecule movement	12
Figure 9.	Effect of diffusion-weighted sequence on water molecules	14
Figure 10.	Black-blood images “DWI of the blood vessels”	16
Figure 11.	Diffusion-weighted image of endometrium	17
Figure 12.	Signal intensity versus b values at DWI of tissue with normal versus restricted diffusion	18
Figure 13.	Logarithm of signal intensity versus b values at DWI of normal liver versus liver tumor.	19
Figure 14.	T2 shine-through	21
Figure 15.	DWI of hemangioma	22
Figure 16.	DWI of hepatocellular carcinoma	25
Figure 17.	DWI of diffuse liver disease	27
Figure 18.	Changes in intranodular hemodynamics and OATP expression during multistep hepatocarcinogenesis	37
Figure 19.	MR Images of cirrhotic nodules	49
Figure 20.	MR Images of low grade dysplastic nodule	52
Figure 21.	MR images of fat-containing high-grade dysplastic nodule	53
Figure 22.	MR images of fat-containing HCC	56
Figure 23.	Enhancement of HCC	57
Figure 24.	HCC with definite capsule appearance	58

Figure 25.	MRI of infiltrative HCC and portal venous thrombosis in a patient with history of excessive alcohol use	60
Figure 26.	MRI of infiltrative HCC and portal venous thrombosis in a patient with history of hepatitis C virus	61
Figure 27.	Hepatobiliary image of infiltrative HCC and portal venous thrombosis	62
Figure 28.	T2WI and DWI of infiltrative HCC and portal venous thrombosis	64
Figure 29.	Sonogram of hypoechoic and echogenic thrombi of main portal vein	66
Figure 30.	A color Doppler US scan and contrast enhanced US scan of a portal vein thrombus	68
Figure 31.	Chronic portal vein thrombosis	69
Figure 32.	Contrast-enhanced CT scan of a bland non enhancing thrombus	70
Figure 33.	Contrast-enhanced CT scan of a malignant thrombus	71
Figure 34.	MR Image of portal vein thrombosis	72
Figure 35.	Angiogram of portal vein thrombus	74
Figure 36.	Angiogram of malignant portal vein thrombus showing vessels within the thrombus	74
Figure 37.	Percentage of the studied benign and malignant cases	87
Figure 38.	HCC ADC	97
Figure 39.	Thrombus ADC	98
Figure 40.	ADC ratio	99

Introduction
&
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 occurs 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).

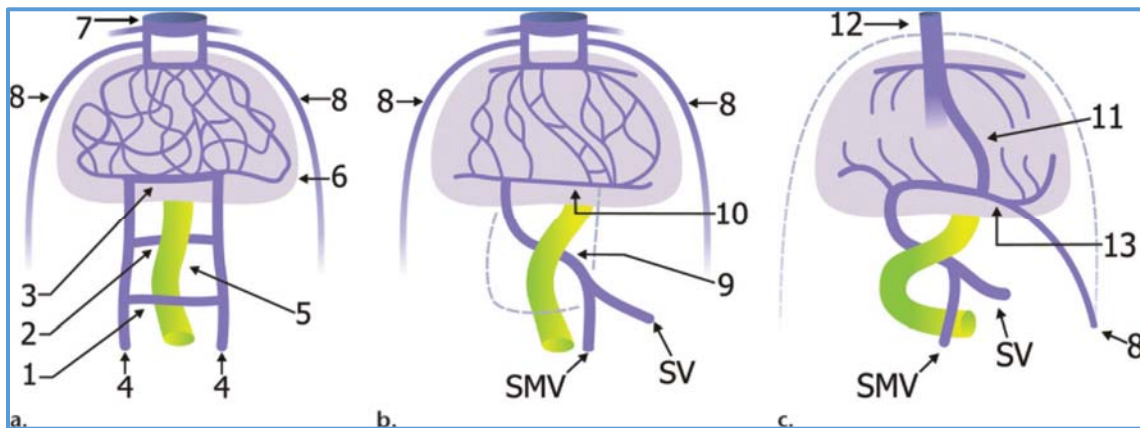


Figure 1. Drawings illustrate the embryologic development of the portal venous system. **(a)** Initially, the caudal-ventral (1), dorsal (2), and cranial-ventral (3) anastomoses develop from the paired vitelline veins (4) around the duodenum (5). They pierce the septum transversum (6), forming multiple 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).