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ORIGINAL ARTICLE

Benign and malignant portal venous thrombosis: Multi-modality imaging evaluation☆

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KEYWORDS

Portal vein thrombosis;
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Abstract *Objective:* To evaluate the value of color Doppler, tri-phasic CT and Diffusion weighted magnetic resonance imaging in differentiating benign from malignant portal vein thrombosis.
Patients and methods: This study included 50 patients presented ultrasonically with PVT referred for discriminating the benign from malignant PVT. The color Doppler US, tri-phasic CT and MR DWI results were compared and correlated with available histopathological results.
Results: Those 50 patients were classified on the bases of imaging criteria and histopathology into two groups: G.(I) included 17 patients with benign PVT and G.(II) included 33 patients with malignant PVT. Intrathrombus pulsatile flow was depicted in 25 patients with malignant PVT (25/33). On tri-phasic CT, neovascularity and early arterial enhancement of PVT were depicted in 28/33 and 29/33 of malignant cases and non-depicted in benign cases with 100% specificity. ADC values for group I was mean + SD (1.1 ± 0.1), median (1.2), and the ADC values for group II was mean + SD (0.7 ± 0.1), median (0.8) with significant *P* value (0.001). ROC curve revealed cutoff value (⩽1), sensitivity (100%), specificity (82.5%).
Conclusion: Distinguishing benign from malignant PVT is required to determine the management plane. The combination of color Doppler US, tri-phasic CT and MR DWI is essential for more accurate evaluation and can obviate FNAC.

1. Introduction

Portal vein thrombosis (PVT) indicates thrombosis that develops in the trunk of the portal vein including its right and left intrahepatic branches. It either occurs in association with cirrhosis or malignancy of liver or may happen without an associated liver disease (1,2).

It is important to differentiate between benign and malignant PVT to determine the management plan (3). The presence of neoplastic thrombus serves as an important determinant of tumor staging, as well as prognosis, and influences treatment selection (4–7).

It is important to remember that most hepatic vascular disorders are often not suspected clinically and are only diagnosed by imaging studies due to non-specific clinical and

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laboratory abnormalities associated with most hepatic vascular lesions (8).

The reference standard for characterizing portal vein thrombus is histopathological examination. However, in clinical practice, diagnostic imaging such as Doppler ultrasonography, contrast-enhanced computed tomography, and MRI imaging, together with clinical and laboratory findings is often relied upon for thrombus discrimination (9).

Color Doppler imaging is often the initial technique of choice for the noninvasive assessment of abnormalities of the portal veins. The use of Doppler US in diagnosis of malignant PVT has been evaluated by several studies as non-visualization of portal venous flow and pulsatile flow in the thrombus (10).

Tri-phasic CT of the liver, using early, late arterial and portal venous phases with fixed time delays is quick, easy and non-invasive useful imaging modality in detection and characterization of the focal lesions and especially the diagnosis of HCC in cirrhotic patients and non-invasively diagnosed PVT and CTPV. However the accuracy of tri-phasic CT scan in diagnosis of PVT, exposure to ionizing radiation and hypersensitivity to contrast media remains major obstacle compared to color Doppler US (11).

Recent reports have highlighted the potential of diffusion-weighted (DW) imaging to differentiate benign from malignant liver lesions (12–14). A recent study concluded that quantitative measurements from diffusion-weighted imaging (DWI) were highly accurate in differentiating these entities (13).

2. Patients and methods

This study was approved by the ethics committee of our institution. This study was carried out on 50 patients referred to the Radiology Department with sonographic evidence of portal vein thrombosis at the period from March 2014 to February 2015. All patients in this study were subjected to the following:

The patient included in this study according the following criteria:

Inclusion criteria: (1) Patients with chronic hepatic disease and PVT. (2) Patients with non-cirrhotic liver presenting with PVT.

Exclusion criteria: (1) Liver biopsy contraindication: increased prothrombin time, international organized ratio (INR) greater than 1.6; (2) Patients with impaired renal functions or terminal liver failure; (3) Pregnancy; (4) The presence of any other malignancies, such as gonadal or gastric malignancies, that may elevate the AFP levels; and (5) the patients with persistent hypotension unresponsive to fluid resuscitation.

All patients were subjected to the following:

(1) *Thorough history taking including:* Special habits e.g. alcoholism present history of hematemesis or melena, jaundice, exposure or intake of hepatotoxic drugs, previous local alcohol injection or any other local ablation for hepatic focal lesion.
(2) *Clinical examination including:* general examination stressing on jaundice and the consciousness level and local abdominal examination, with stressing on liver, spleen, ascites and collaterals.

Table 1 Real time ultrasound and color Doppler findings of our 50 patients.

Real time US finding	Group I Benign cases (17)		Group II Malignant cases (33)	
	No. of patients	(%)	No. of patients	(%)
Liver cirrhosis				
Present	15	88.23	33	100
Absent	2	11.76	0	0
Hepatic mass				
Solitary			15	45.45
Multicentric			18	54.54
Hypoechoic			6	18.18
Iso to Hyper echoic			10	30.30
Heterogeneous			17	51.51
Spleen				
Splenomegaly	11	64.7	31	93.9
No Splenomegaly	6	35.2	2	6.06
Ascites				
Absent	6	35.29	13	39.39
Mild	9	52.94	10	30.30
Moderate	2	11.76	5	15.15
Marked	0	0	5	15.15
Color Doppler findings				
PV thrombus				
Main PV	17	100	27	81.81
Right Branch	3	17.6	17	51.51
Left branch	1	5.8	4	12.12
Intra thrombus flow				
Pulsatile flow	0	0	25	75.75
No pulsatile flow	17	17	8	24.24

Table 2 Triphasic CT findings of our 50 patients.

Triphasic CT finding	Group I (benign cases) $N = 17$	Group II (malignant cases) $N = 33$	P value
(1) PVT Triphasic CT characteristics			
(i) Neovascularization of the thrombus	0 (0%)	28 (84.84%)	0.004
(ii) Arterial enhancement with rapid washout	0 (0%)	29 (87.87%)	0.004
(iii) Direct invasion by adjacent hepatic mass	0 (0%)	25 (75.75%)	0.004
(iv) Diameter of the thrombus >23	0 (0%)	25 (75.75%)	0.002
(2) Hepatic focal lesion CT characteristics			
(i) Solitary	0	3 (9.09%)	0.1
(ii) Multi-centeric	0	28 (84.84%)	0.007
(iii) Diffuse	0	2 (6.06%)	0.1
(iv) Early arterial enhancement with rapid washout	0	33 (100%)	0.009