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MRI diffusion-weighted imaging detects a fresh portal vein thrombus as a high intensity lesion in a patient with a liver transplant: A case report

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Abstract

Portal vein thrombosis is one of the most serious complications after liver transplantation. It is important to determine the age of the thrombus for management of portal vein thrombosis. We present a case report of histologically confirmed heterogenous fresh portal vein thrombus which was depicted heterogenous high signal intensity on magnetic resonance diffusion weighted imaging. The sequence may be a useful imaging tool for detecting fresh thrombus components in the portal vein thrombosis.

Keywords

Diffusion weighted imaging, portal vein thrombosis, thrombus age

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Introduction

Portal vein thrombosis is one of the most serious complications after liver transplantation. The thrombus is subsequently organized and replaced by fibrous tissue, which makes it resistant to anti-thrombotic therapies. Because anti-thrombotic therapies have a risk of bleeding and the current guidelines recommend different anticoagulant strategies for patients with acute and chronic portal vein thrombosis (PVT), it is important to discriminate acute from chronic PVT or detect fresh components in the PVT.[1] However, current imaging modalities including ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) cannot always detect fresh components of the PVT.

Case presentation

We report the case of a man in his 50 s who underwent liver transplantation 8 years ago for the treatment of hepatitis C virus-related liver cirrhosis with hepatocellular carcinoma. He had a bile duct stent inserted for bile duct stenosis 4 years ago, but suffered from recurrent cholangitis. He was admitted to our hospital with fever and abdominal pain. Contrast-enhanced CT revealed a large filling defect in the portal vein to superior mesenteric vein. Abdominal MRI was performed with a 3T magnetic resonance system (Philips Ingenia Elition X, Philips Medical Systems, Best, the Netherlands) at 2 days after the admission. The

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transverse and coronal views of modified dual-echo generalized Dixon-3D gradient-recalled-echo T_1 weighted image (T_1WI) and T_2 weighted image (T_2WI) confirmed the presence of a large thrombus extending from the main portal vein to superior mesenteric vein. The thrombus appeared with heterogeneous low to iso signal intensity with marginal high signal intensity relative to muscle on T_1WI and heterogeneous high signal intensity relative to muscle on T_2WI (Fig. 1(a)). The main portal vein and superior mesenteric vein portions of the thrombus showed different findings on DWI and a merged image of DWI and T_1WI. The images had a heterogeneous high signal intensity in the main portal vein portion of the thrombus (Fig. 1(b), left column) and low signal intensity in the superior mesenteric vein portion (Fig. 1(b), right column). The apparent diffusion coefficient (ADC) depicted the main portal vein portion with low signal intensity and the superior mesenteric vein portion with heterogeneous high signal intensity. After the administration of antibiotics and endoscopic bile duct stent replacement, the patient underwent endovascular thrombectomy via the transmesenteric route under minilaparotomy and thrombolysis therapy. Histology and immunohistochemistry showed that the removed main portal vein thrombus was composed of erythrocytes, fibrin, and platelets (Fig. 2(a)) with some cell lytic changes (Fig. 2(b)). No endothelialization or organizing reaction was observed in the thrombus. The superior mesenteric vein portion of the thrombus depicted with low signal intensity on DWI remained 10 weeks after the thrombolysis with contrast-enhanced CT.

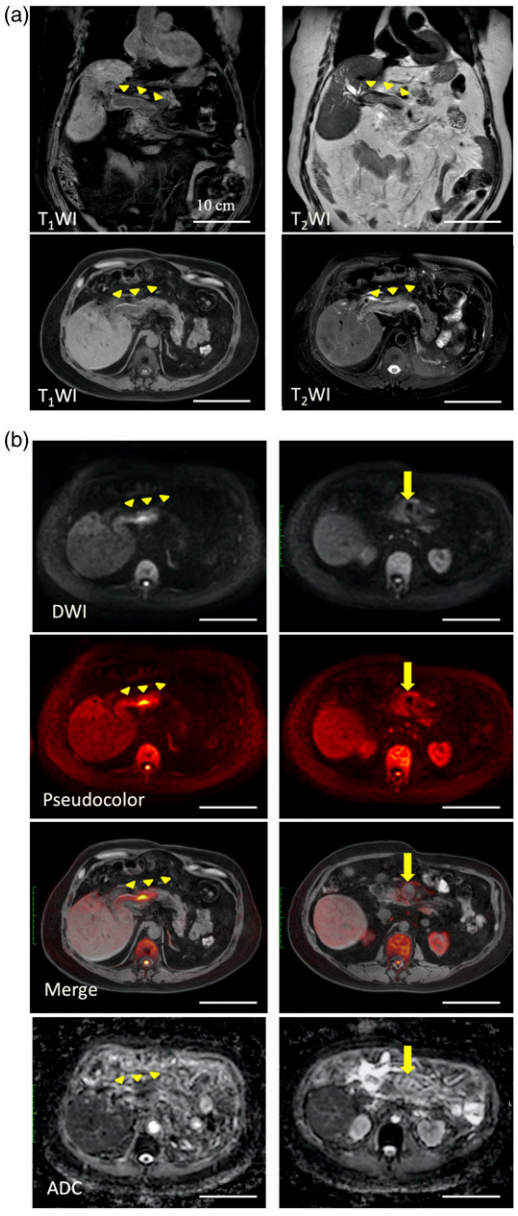

Fig. 1. Magnetic resonance imaging of portal vein thrombosis. (a). Coronal and transverse images on T_1WI (water image) and T_2WI of the main portal vein thrombus. The thrombus in the main portal vein showed low to iso signal intensity with marginal high signal intensity relative to muscle on T_1WI, and heterogeneous high signal intensity relative to muscle on T_2WI (arrowheads). (b). Transverse images on DWI (b-value 1000 s/mm^2), its pseudocolor image, a merged image of T_1WI and DWI, and ADC of the main portal vein portion of the thrombus (left column) and superior mesenteric vein portion of the thrombus (right column). The merged image shows the main portal vein portion of the thrombus (arrow) as heterogeneous high signal intensity relative to muscle on DWI, whereas the superior mesenteric vein portion (arrowheads) is shown with low signal intensity on DWI. ADC depicts the portion vein portion with low signal intensity and superior mesenteric portion with heterogeneous high signal intensity. ADC: apparent diffusion coefficient.

Discussion

DWI and a merged image of DWI and T_1WI visualized different signal intensities in the portions of the PVT. The main portal vein portion of the thrombus was composed of fresh components, with some cell lytic changes, which might reflect 3–8 days of deep vein thrombus.[2] Rabbit venous thrombus was depicted with high signal intensity on DWI at 4 h and heterogenous high signal intensity at 1 week after thrombus formation.[3] Therefore, the heterogenous high signal intensity in the main portal vein portion of the thrombus on DWI may reflect heterogenous fresh components of the thrombus. Although we did not examine the superior mesenteric vein portion histologically, low signal intensity on DWI and the resistance to thrombolysis suggest that the superior mesenteric vein portion is in the organizing or organized phase of thrombus.

Few case studies have reported MRI findings of acute, subacute, and chronic PVT. In 14 patients with PVT, subacute PVT (<5 weeks old) appeared with high signal intensity

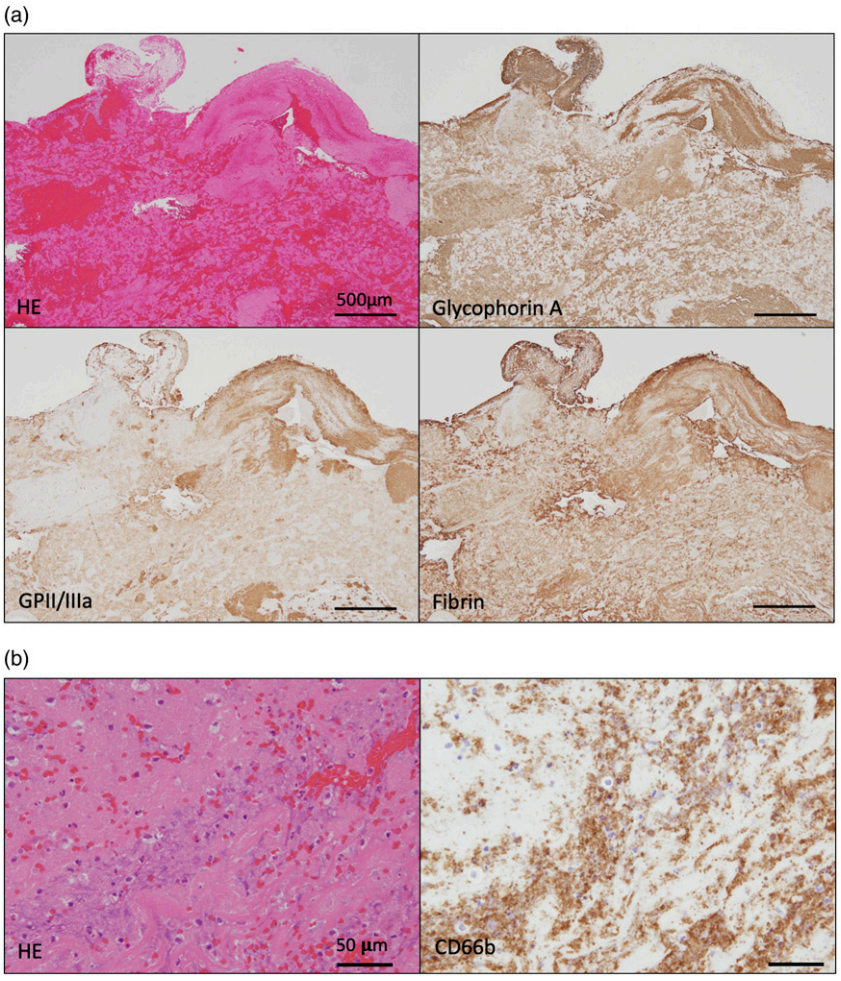

Fig. 2. Representative histological and immunohistochemical microphotographs of the portal vein thrombus obtained by thrombectomy. (a). The thrombus is admixed with dense eosinophilic and pale eosinophilic areas without an organizing reaction. HE (hematoxylin and eosin). The dense eosinophilic area is rich in erythrocytes (glycophorin) and fibrin, and the pale eosinophilic area is rich in platelets (GPIIb/IIIa) and fibrin. (b). The thrombus also shows cell lytic change. Immunohistochemistry for CD66b highlights fragmentation of neutrophils.

relative to the liver and muscle on T_1WI and T_2WI, and chronic PVT (2–18 months old) appeared with high signal intensity on T_2WI alone.[4] In 9 patients with splanchnic vein thrombosis, subacute (< 6 weeks old) and chronic (> 2 months old) thrombi appeared with high and iso signal intensities on T_1WI, respectively.[5] Van Dam et al.[6] recently reported the first phase of the Rhea study (NTR 7061) to select MR non-contrast thrombus imaging sequences that were accurate for the differentiation of acute (<2 weeks of symptoms) from chronic (asymptomatic, non-resolvable) PVT. One acute and two chronic PVT cases showed high signal intensity or iso signal intensity on three-dimensional T_1 turbo field echo and three-dimensional T_1 fast field echo sequences, respectively. In contrast to previous studies, the histologically fresh main portal vein thrombus showed low to iso signal intensity with marginal high signal intensity on T_1WI. This difference may be related to the thrombus age. The sequential changes of T_1WI of venous thrombus were examined in a rabbit venous thrombus model.[7] The venous thrombus at 4 h had iso signal intensity on T_1WI, and peak median values of signal intensity of the venous thrombus on T_1WI were at 1 week.[7] MRI performed 2 days after the onset showed the main portal vein thrombus almost completely consisted of heterogenous fresh components of thrombus. Therefore, the heterogenous fresh components were too early to depict the main portal vein portion with high signal intensity on T_1WI.

Relatively low spatial resolution is a disadvantage of DWI. T_1WI has good spatial resolution and reliable sequencing for the detection of conventional deep vein thrombosis.[8] Therefore, we used a merged image of T_1WI and DWI, which showed a localized high signal

intensity lesion on DWI in the portal vein. This may discriminate PVT from neoplastic or inflammatory lesions in the abdomen. However, an important differential diagnosis is tumor thrombus of hepatocellular carcinoma. Two studies[9,10] evaluated DWI for the differentiation between benign and malignant PVT, but failed to find significantly different parameters by DWI. Although one of the studies showed the utility of postcontrast MRI sequences for the differentiation of malignant PVT from benign PVT,[10] this is a limitation of DWI sequencing for PVT diagnosis.

In conclusion, our case showed DWI might be useful for the detection of fresh thrombus components in PVT complicated in liver transplant patients. Further study is required to validate the usefulness of DWI for PVT.

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Declaration of conflicting interests

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Informed consent

The authors obtained verbal and written informed consent by the patient about his/her condition being presented in a case report.

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