

Vessel-penetrating sign in the liver: MR imaging manifestations of various liver pathologies

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[Purpose] Preserved intrahepatic vessels may be observed within various benign and malignant pathologies in the liver as "vessel-penetrating sign" (VPS) on imaging such as US, CT and MRI. MRI has an advantage to demonstrate vessels without the administration of contrast medium as flow voids on spin echo sequences with long TR; echo planar diffusion-weighted imaging, or as high signal intensity structures on gradient echo sequences with steady state free precession. The presence of VPS suggests infiltrative tumor growth, highly non-destructive tumors, mass formed by the aggregated malignant tumors, or benign tumor-like conditions. In this exhibit we present diagnostic imaging features of various liver lesions, which show VPS, with pathologic correlation.

[Outline of Content] VPS may be observed in **1) Benign tumor-like conditions** such as *Mottled fatty liver*, *Inflammatory pseudotumor*, and *Peliosis hepatica*. **2) Malignant but highly non-destructive tumors** such as *Malignant lymphoma* and *Early stage hepatocellular carcinoma*. **3) Malignant tumors with infiltrative extent** such as *Cholangiocellular carcinoma* and *Cholangiolocellular carcinoma*. **4) Mass formed by the aggregated malignant tumors** such as *Metastasis* and *Diffuse or Massive hepatocellular carcinoma*.

[Summary] The presence of VPS is suggestive for liver pathologies with some characteristic histologic features. Problem-solving MR techniques such as dynamic MRI; diffusion-weighted imaging with ADC measurement; fat-saturated MR imaging; chemical shift imaging etc. and clinical information such as the presence of chronic liver disease; characteristic symptoms; under hyperalimentation; cancer-laden patients etc. may lead to the correct diagnosis.

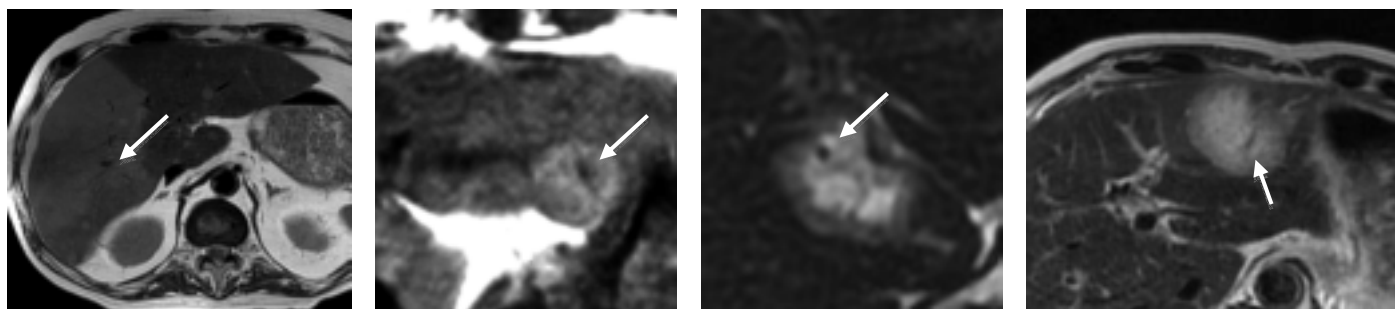


Fig. 1: Malignant lymphoma: On T2WI, diffuse high intensity area is observed in the right lobe. VPS (arrow) is evident. Malignant lymphoma is highly non-destructive tumor, and even a huge mass like this case VPS is commonly observed. This case shows very high signal intensity on DWI; high FDG uptake on PET/CT, which are suggestive for malignant lymphoma.

Fig. 2: Early stage hepatocellular carcinoma: On T1WI, well-demarcated high intensity mass with VPS (arrow) is observed in cirrhotic liver. Well differentiated, early stage hepatocellular carcinoma may appear as hypovascular mass with portal blood supply, and tend to show high intensity on T1WI. Preserved portal vein within the mass may often be observed due to non-destructive tumor growth of low-grade, well differentiated cancer cells resembling non-cancerous hepatocytes.

Fig. 3: Cholangiolocellular carcinoma: On T2WI, well-demarcated, lobular mass with VPS (arrow) is observed. Peripheral area shows slight high intensity on T2WI; very high intensity on DWI; intense early-enhancement on dynamic MRI like cholangiocellular carcinoma. VPS is common finding in cholangiolocellular carcinoma, and suggestive for this rare neoplasm observed in well-demarcated mass exhibiting cholangiocellular carcinoma-like signal intensity and dynamic pattern.

Fig. 4: Cholangiolocellular carcinoma: On T2WI, well-demarcated high intensity mass with VPS (arrow) is observed in non-cirrhotic liver. VPS is relatively rare in well-demarcated mass-forming type cholangiocellular carcinoma, but may be observed due to its microscopically infiltrative nature.

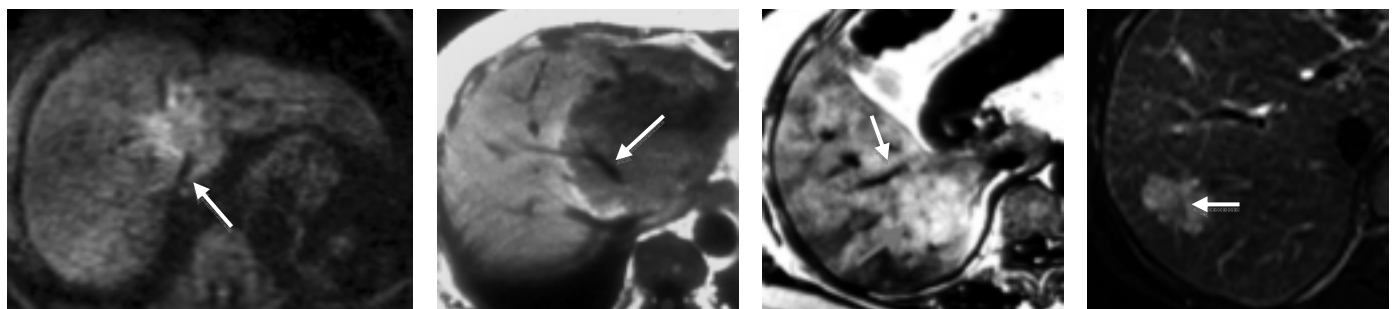


Fig. 5: Cholangiolocellular carcinoma: On DWI, ill-defined high intensity tumor with highly infiltrative growth shows VPS (arrow). Infiltrative-type cholangiolocellular carcinoma may grow along the Glisson sheath and commonly show VPS.

Fig. 6: Inflammatory pseudotumor: On T1WI, large low intensity mass with VPS (arrow) is observed. The patient complained of chills and fever. This mass is formed by the aggregation of microabscesses and inflammatory granulation tissue. VPS is often observed in such non-neoplastic, tumor-like conditions.

Fig. 7: Mottled fatty liver: On T1WI, multiple high intensity masses and nodules are observed with VPS (arrow). Non-neoplastic, fatty infiltration may mimic tumors, and fat-saturated MR imaging is helpful for the diagnosis.

Fig. 8: Peliosis hepatica: On fat-saturated T2WI, irregular-shaped high intensity mass with VPS (arrow) is observed. Extensive dilated sinusoid in the liver parenchyma may cause the mass-like appearance on imaging, and vessels may be involved in the peliotic area.