Gastrointest Radiol 16:221–224 (1991)

Gastrointestinal Radiology

Magnetic Resonance Imaging of Macroscopic Intrahepatic Portal-Hepatic Venous Shunts

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Abstract. Direct communication between portal branches and the hepatic vein [macroscopic intrahepatic portal-hepatic venous shunt (IPHVS)] is a rare entity. We have recently studied five patients with this condition. Magnetic resonance imaging (MRI) clearly demonstrated in each case the portal-hepatic venous shunt due to "flow void." Multiple diffuse shunts were present in one case and a solitary shunt was demonstrated in the others. The solitary shunt was either tubular, focally dilated or racemose in configuration. The MRI findings and clinical significance of this rare entity are discussed.

Key words: Portal vein – Portal-hepatic venous shunt, MRI.

With the increased use of noninvasive and high-resolution imaging modalities, such as ultrasonography (US) and computed tomography (CT), a rare entity of intrahepatic direct communication between a portal venous branch and the hepatic vein [macroscopic intrahepatic portal-hepatic venous shunt (IPHVS)] has been sporadically reported [1–5]. Magnetic resonance imaging (MRI) findings of this entity, however, have not been reported. We have recently examined five patients with IPHVS using MRI, the findings of which are the focus of this report (Table 1).

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Case Reports

Case 1

A 44-year-old man had an abdominal sonogram, which revealed the anterior segment of the right and left lobe of the liver crowded with unusual blood vessels (Fig. 1A). CT with rapid intravenous infusion of contrast agent showed enhancement of these vessels. MRI clearly demonstrated these vessels as hypointense structures due to "flow void" (Fig. 1B) and suggested direct communication between portal branches and the middle hepatic vein. The portal phase of celiac and superior mesenteric arteriography was not diagnostic. Subsequent percu-

Table 1. Summary of five patients with macroscopic IPHVS

Case	Age	Sex	Portal-hepatic venous shunt			Liver dysfunction
			Multiplicity configuration	Location	Draining vein	
1	44	M	Multiple diffuse	Both lobes	Left h.v. mid. h.v.	No
2	55	F	Solitary focal dilatation	Inf. post. subsegment	Right h.v.	No
3	57	M	Solitary tubular	Sup. post. subsegment	Accessory right h.v	Budd-Chiari sx. cirrhosis
4	60	F	Solitary racemose	Sup. ant. subsegment	Right h.v.	Cirrhosis
5	63	F	Solitary focal dilatation	Sup. ant. subsegment	Right h.v.	Cirrhosis

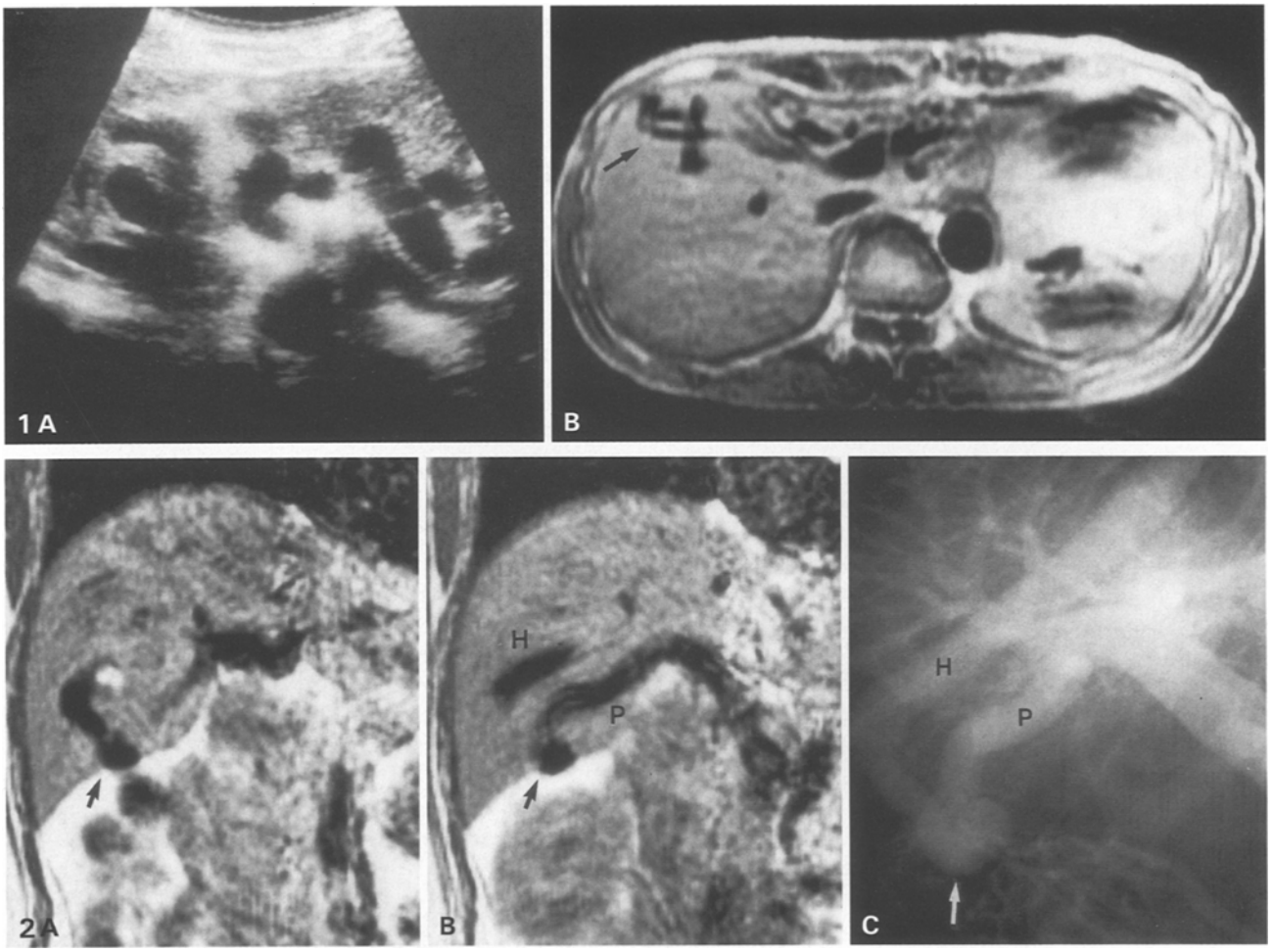

Fig. 1. *Case 1.* **A** A transverse ultrasonograph shows unusual blood vessels in the left lobe of the liver. **B** MRI (TR 2000 ms, TE 20 ms) reveals the unusual vessels and IPHVS (*arrow*).

Fig. 2. *Case 2.* **A, B** Two contiguous oblique cuts of MRI (TR 750 ms, TE 20 ms) show a mildly dilated portion (*arrow*) communicating the right branch of the portal vein (*P*) with the right hepatic vein (*H*). **C** Portal phase of superior mesenteric arteriography demonstrates the IPHVS (*arrow*).

taneous transhepatic portography showed multiple IPHVS diffusely distributed in both lobes of the liver.

Case 2

A 55-year-old woman with epigastric pain had an MRI examination, which showed a dilated inferior-posterior subsegmental branch of the right portal vein communicating with the right hepatic vein (Fig. 2A and B). The findings were confirmed by angiography (Fig. 2C).

Case 3

A 57-year-old man with dual obstruction of the inferior vena cava at the diaphragmatic and the infrarenal portions had an MRI, which showed a direct tubular communication between the superior-posterior subsegmental branch of the right portal vein and an accessory right hepatic vein (Fig. 3A). CT did not detect the communication, whereas arteriography confirmed the MRI finding (Fig. 3B).

Case 4

A 60-year-old woman with abnormal liver function tests had an abdominal CT which showed an irregular hepatic contour with moderate splenomegaly. MRI revealed a racemose IPHVS in the right lobe (Fig. 4), which was confirmed by subsequent angiography.

Case 5

A 63-year-old woman with a similar clinical presentation to case 4 had an MRI examination, which showed an IPHVS in the right lobe (Fig. 5). This was also confirmed by angiography.

Discussion

Shunts from the portal venous system to the systemic venous system can be classified into three

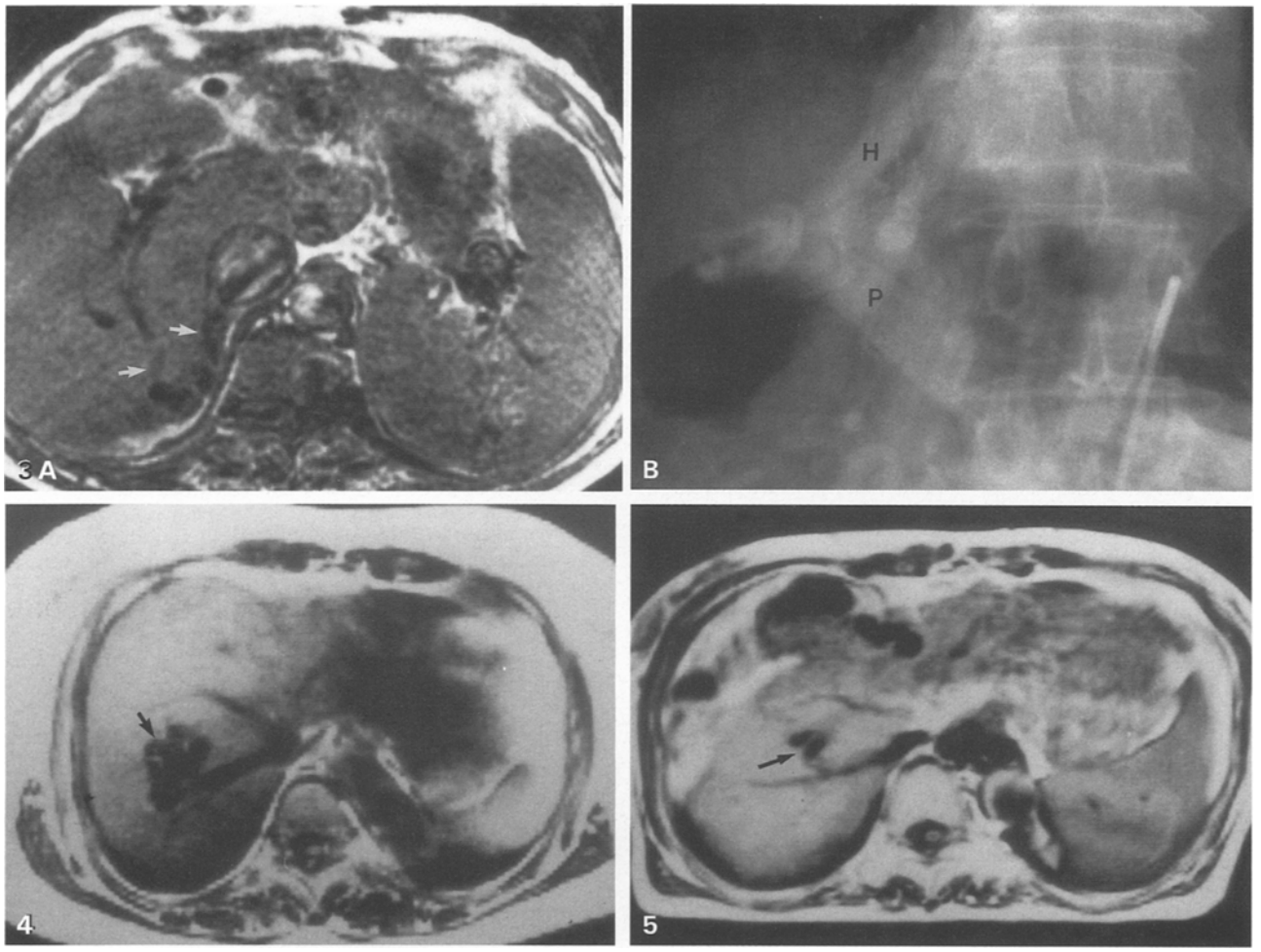

Fig. 3. *Case 3.* **A** MRI (TR 2500 ms, TE 30 ms) shows a tubular IPHVS (*arrows*). **B** Portal phase of celiac arteriography also reveals the IPHVS (*arrows*).

Fig. 4. *Case 4.* MRI (TR 1600 ms, TE 35 ms) shows a racemose IPHVS (*arrow*).

Fig. 5. *Case 5.* MRI (TR 500 ms, TE 35 ms) shows a small IPHVS (*arrow*).

basic groups; (1) extrahepatic hepatofugal shunts, (2) intrahepatic microscopic or functional shunts [6–9], and (3) macroscopic IPHVS. Extrahepatic hepatofugal shunts are well-visualized radiologically, whereas microscopic intrahepatic shunts are beyond the resolution of an imaging test. Macroscopic IPHVS were rarely detected before the widespread use of US and CT. Horiguchi et al. [4] reported only two cases [10, 11] before the introduction of these diagnostic modalities, while six cases, including those of their own, were reported within 2 years after their use. Likely etiologies of these macroscopic shunts include congenital [10], rupture of portal venous aneurysm [12, 13], patent or reopening of ductus venosus [1] in a cirrhotic patient, and acquired vascular disorder as a sequela to parenchymal collapse from hepatitis [11].

Since US is most widely used for screening examinations of the abdomen, most cases of macroscopic IPHVS have been found with this modality. CT can detect these shunts; however, MRI detects these shunts more clearly than CT because of the higher contrast between the hepatic parenchyma and the blood vessels. MRI appears to be one of the most reliable modalities for the diagnosis of macroscopic IPHVS and can supplement US which is often unsatisfactory in obese patients, those who have a lot of gas-filled intestinal loops, and cirrhotic patients with a contracted liver hidden in the costal cage.

Macroscopic IPHVS presents itself either as a solitary lesion or multiple lesions. The solitary type appears to be more common. In the multiple type,

small shunts are diffusely distributed and arterial portography may fail to demonstrate the shunts clearly, which was true in our case 1 and two reports in the literature [3, 14], presumably due to the small caliber of individual shunts. In the solitary type, the shunt is either tubular with no local dilatation (case 3 in our series), has local dilatation (cases 2 and 5), or racemose with crowded vessels (case 4). When the local dilatation is prominent, the rupture of a portal venous aneurysm into the hepatic vein may be suggested as an etiology.

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Received: July 23, 1990; accepted after revision: October 2, 1990