Evaluation of Gd-EOB-DTPA for Focal Hepatocellular Lesions: Correlation with Multi-Modality Imaging Findings and Pathology

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Introduction: Gadolinium-ethoxybenzyl-DTPA (Gd-EOB-DTPA) is partially taken up by hepatocytes followed by biliary excretion, yielding a positive and sustained liver enhancement in the hepatobiliary phase. Initial clinical experiences suggested the usefulness of this agent for malignant hepatic lesions by the combination of dynamic enhancement characteristics in early phase and negative enhancement in the hepatobiliary phase [1-2]. However, the positive enhancement of hepatocellular carcinomas (HCC) has been shown for experimental hepatic tumors [3]. There have been few reports about the relevance of Gd-EOB-DTPA enhancement characteristics in the hepatobiliary phase and its contribution to the differential diagnosis. We reviewed hepatocyte-derived lesions, and correlated the enhancement characteristics of Gd-EOB-DTPA-enhanced MR imaging and other imaging modalities with pathological findings.

Methods: From the phase II and phase III clinical trials at our institute, 16 patients with 18 pathologically proved focal hepatic lesions were included in this study. Five lesions were surgically resected, and other 13 were proved by percutaneous biopsy. Lesions consisted of 6 benign focal hepatic lesions (3 dysplastic nodules [DN], 1 hyperplastic nodule [HPN], 1 focal nodular hyperplasia [FNH], 1 partial nodular transformation [PNT]) and 12 malignant ones (3 well-differentiated HCCs [w-HCC], 4 well-moderately differentiated HCCs [wm-HCC], 5 moderately- or moderately-poorly differentiated HCCs [m-HCC or mp-HCC]). All patients underwent MR imaging at 1.5 tesla (Signa, GE) consisting of T2-weighted (T2W) fast spin echo (2500/90) and T1-weighted (T1W) gradient echo (fast spoiled GRASS [FSPGR] 130/2/90^{o}). Serial MR imaging (FSPGR) was performed at 30 seconds, 1-3 minutes, and 10-20 minutes after the start of intravenous Gd-EOB-DTPA (12.5-25 μmol/kg) administration. Imaging findings of unenhanced MRI, Gd-EOB-DTPA-enhanced MRI, ultrasound (US), CT during arterial portography (CTAP), and CT during hepatic arteriography (CTHA) were reviewed and compared with pathological findings. The lesion echogenecity, CT density, or MR signal intensity was categorized into 5-point scale by visual inspection under the consensus of two experienced radiologists; 5: strongly increased, 4: slightly or partially increased, 3: same degree, 2: slightly or partially decreased, 1: strongly decreased, as compared with the surrounding liver.

Results: The table shows the detail of imaging findings and pathological diagnosis. On Gd-EOB-DTPA-enhanced T1W-GRE, one w-HCC and one wm-HCC showed partially increased (rank 4) or strongly increased signal intensity (rank 5) as compared with the surrounding liver in the hepatobiliary phase (Figure 1). Pathological examination revealed an abundant production of bile within these HCCs. Other 10 HCCs showed low signal intensity, without apparent bile production pathologically. Three benign lesions (two DN and one PNT) showed low signal intensity as compared with the surrounding liver (Figure 2). If the low intensity pattern or high intensity pattern in the hepatobiliary phase was designated as "malignant" or "benign", respectively, the diagnostic accuracy in differentiating between malignant and benign lesions was 72% (13 of 18). There was a statistically significant difference in Gd-EOB-DTPA enhancement pattern between the malignant and benign group (U-test, p=0.033).

Discussion and Conclusion: Hepatocyte-derived malignant hepatic lesions often possess sustained uptake function of hepatocytes. Ni et al [4] first described the prolonged enhancement of Gd-EOB-DTPA in w-HCC. This phenomenon much less frequently occurs in experimentally induced malignant hepatic lesions [4]. Although there was a statistically significant difference between the malignant and benign group, a considerable overlap may still bring up an important question in tissue characterization by Gd-EOB-DTPA-enhanced MR imaging [5]. In addition, bile excretion within the tumor may play an important role for positive enhancement in the hepatobiliary phase. Further studies will be necessary to investigate the significance of positive enhancement by Gd-EOB-DTPA, in view of biological behavior (malignant potential) of the lesion.

References:

1. Vogl TJ, et al. Radiology 1996; 200: 59-67.
2. Reimer P, et al. Eur Radiol 1997; 7: 275-280.
3. Fujita M, et al. JMRI 1996; 6: 472-477.
4. Ni Y, et al. JMRI 1994; 4: 355-363.
5. Tsuda N, et al. Invest Radiol 2004; 39: 80-88.

Table: Scores of Imaging Findings and Pathology

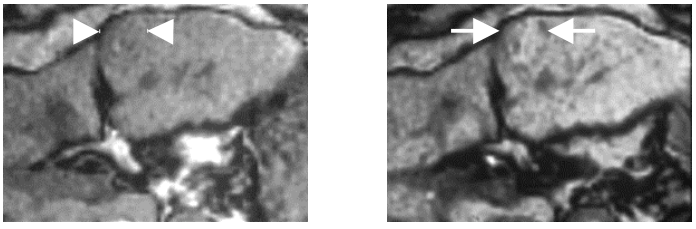
Pt.	size(cm)	US	CTHA	CTAP	T2W	T1W	EOB*	Pathology
72M	2.1	5	4	1	5	3	5	w-HCC
68M	2.4	4	4	1	3	5	1	w-HCC
67F	2.2	3	5	1	4	1	1	w-HCC
69M	2.4	2	5	1	5	4	4	wm-HCC
69F	2.0	4	4	1	5	1	1	wm-HCC
66M	1.6	1	5	1	5	1	1	wm-HCC
73M#	1.8	5	3	1	4	3	1	wm-HCC
73M#	2.7	1	5	1	5	1	1	mp-HCC
45M	4.5	4	5	1	5	3	2	m-HCC
52M	1.5	1	5	1	5	1	1	m-HCC
66M	2.8	1	5	1	4	1	1	m-HCC
79M	5.2	4	5	1	5	1	2	m-HCC
65M	2.5	1	1	3	1	5	2	DN
66F!	1.2	5	1	2	3	5	2	DN
66F!	1.0	5	1	3	3	4	3	DN
65M	1.8	5	3	3	3	3	3	HPN
29F	3.0	2	2	4	3	4	2	PNT
38M	7.0	4	5	1	5	1	4	FNH

#, !: same patient

*. lesion-liver contrast in the hepatobiliary phase

Figure 1: 72M w-HCC (arrowheads)

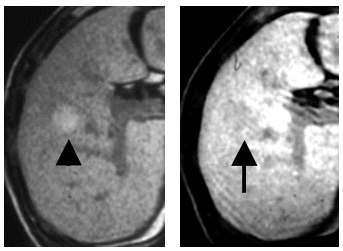
precontrast T1W hepatobiliary phase



In the hepatobiliary phase, the lesion was strongly enhanced as compared with the surrounding liver parenchyma (white arrows).

Figure 2: 65M DN

In the hepatobiliary phase, the DN nodule (arrowhead) showed slightly low signal intensity as compared with the surrounding liver parenchyma (arrow).



precontrast T1W hepatobiliary phase