Hypervascular hepatic lesions: dynamic and late enhancement patterns with gadobenate dimeglumine

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The enhancement patterns of 382 hypervascular liver lesions were evaluated following dynamic and delayed (1h–3h) MR imaging with Gd-BOPTA. Qualitative assessment was performed of lesion signal intensity and homogeneity in the different phases. The sensitivity, specificity, PPV and NPV of delayed hyperintensity as a sign of lesion benignity was 64.1%, 98.3%, 97.88% and 69.4%, respectively. The corresponding values for delayed hypointensity as a sign of malignancy were 94.2%, 77%, 77.3% and 94.2%. Iso or hyperintense lesions on delayed images are more than likely benign while hypointense lesions should be subjected to FNAB if dynamic imaging is not specific.

Introduction

Hypervascular liver lesions may be either benign or malignant, primary or secondary, and a well-defined CT and MRI symptomology exists for their characterization. Nevertheless, it is not always possible to accurately diagnose the nature of a given lesion owing to the fact that different lesion types often have similar enhancement/behavior patterns on CT or MRI. The frequent atypical appearance of certain lesion types (e.g. FNH) might further complicate the diagnosis. Gadobenate dimeglumine (Gd-BOPTA, MultiHance; Bracco Imaging SpA, Milan, Italy) is a gadolinium-based MR contrast agent which behaves as a conventional gadolinium agent in the first minutes after administration and as a liver-specific agent in a more delayed phase at 1h–3h post-injection. The benefits of Gd-BOPTA for liver lesion detection and characterization have recently been reported (1-4). The present study was aimed at further evaluating the relative merits of dynamic and delayed MR imaging with Gd-BOPTA for the characterization of hypervascular liver lesions. For comparison, the characteristic lesion enhancement patterns with the liver-specific contrast agents Mn-DPDP and SPIO are described.

Material/Methods

203 patients with 382 hypervascular liver lesions [141 FNH, 26 nodular regenerative hyperplasia (NHR), 12 hepatic adenoma (HA), 30 liver adenomatosis (LA), 94 HCC, 3 fibrolamellar HCC (Fl-HCC), 13 peripheral colangiocarcinoma (PCC), and 63 metastases (M)] underwent dynamic and delayed phase (1h–3h) Gd-BOPTA-enhanced MR imaging. Imaging of all patients was performed at 1.5T. Pre-contrast T2-weighted turbo spin echo images (T2wSE: TR/TE = 4000/108) and pre-and post-contrast T1-weighted gradient echo images (T1wGRE: TR/TE/FA = 140-120/4 /80°) were acquired. The T1wGRE images were acquired during the dynamic phase of contrast enhancement at 25-30 s (arterial phase), 70-90 s (portal-venous phase) and 3-5 min (equilibrium phase) following the bolus administration of 0.1 mmol/kg Gd-BOPTA, and at 1h–3h post-injection (delayed phase).

Qualitative analysis by three radiologists of equal experience comprised an assessment of the lesion signal intensity during each acquisition phase and a determination of the homogeneity / inhomogeneity of the arterial phase enhancement. Comparison of the lesion signal intensity in the different phases was achieved using the Mann-Whitney U test. Analysis of the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Gd-BOPTA in suggesting lesion benignity or malignancy according to the delayed appearance was performed.

Results

Dynamic phase imaging: on arterial phase images hyperintensity was noted for all FNH (99.3% homogeneous), NRH (100% homogeneous), HA (58.3% homogeneous), LA (66.7% homogeneous), FL-HCC (100% heterogeneous), PCC (7.7% homogeneous) and M (73% homogeneous). For HCC 90/94 lesions (96%) were hyperintense on arterial phase images (48% homogeneous).

Delayed phase imaging: of 137 hyperintense lesions on delayed phase images, 134 (97.8%) were benign (108 FNH and 26 NRH) and only 3 (2.7%) malignant (in each case HCC with a dishomogenous appearance in a cirrhotic liver). Of 34 isointense lesions on delayed phase images 26 (76.4%) were FNH, 1 (2.9%) was HA, and 7 (20.6%) were HCC. Of 210 hypointense lesions on delayed phase images, only 7 (3.3%) were FNH and these were only slightly hypointense. A further 41 (19.5%) were HA or LA while the remaining 163 lesions (77.6%) were malignant (Table 1).

Table 1

		Intensity in hepatocellular phase		
Lesions	No.	Hyper	Iso	Hypo
FNH	141	108	26	7
NRH	26	26	0	0
HA	12	0	1	11
LA	30	0	0	30
HCC	94	3	7	84
FL-HCC	3	0	0	3
PCC	13	0	0	13
Mets	63	0	0	63

Considering delayed phase lesion hyperintensity as a sign of lesion benignity, these results imply a sensitivity of 64.1%, a specificity of 98.3%, a PPV of 97.8% and an NPV of 69.4% (Table 2). If delayed phase iso/hyperintensity is considered a sign of benignity the results indicate a sensitivity of 77%, a specificity of 94.2%, a PPV of 94.2% and a NPV of 77.3%. Conversely, if delayed phase hypointensity is considered a sign of malignancy the results imply a sensitivity of 94.2%, a specificity of 77%, a PPV of 77.3% and an NPV of 94.2%.

Table 2

	Hyper = benign	Iso/hyper = benign	Hypo = malignant
Sensitivity	64.1%	77%	94.2%
Specificity	98.3%	94.2%	77%
PPV	97.8%	94.2%	77.3%
NPV	69.4%	77.3%	94.2%

Discussion

The results indicate that in an otherwise healthy liver an iso/hyperintense lesion on delayed images after Gd-BOPTA administration is more than likely a benign lesion. An iso/hyperintense lesion in a cirrhotic liver, however, may be malignant. On the other hand, a hypointense lesion on delayed images in an otherwise healthy liver is highly suggestive of malignancy or of adenoma or adenomatosis. Since adenomas are frequently candidates for surgical resection, the recommendation is for all hypointense lesions on delayed images to be subjected to FNAB if dynamic imaging is not specific in indicating its nature.

References

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