

# Triple arterial and portal venous phase dynamic MRI of liver: to differentiate malignant and hypervascular benign focal lesions by enhancement curve and parameters

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## Purpose

To investigate the efficacy of enhancement curve and parameters obtained from triple arterial and portal venous phase dynamic MRI of liver to differentiate malignant (hepatocellular carcinoma, HCC) and hypervascular benign focal lesions (hemangioma and focal nodular hyperplasia, FNH).

## Materials and methods

Twenty seven patients with 35 HCCs and 15 patients with 16 hepatic hypervascular benign focal lesions (11 patients with 11 hemangiomas and 4 patients with 5 FNHs,) underwent triple arterial and portal venous phase dynamic MRI of liver. GE 1.5T superconductive MR system, combined with 8-channel body array coil and ASSET parallel acquisition technique was employed. The sequence used for gadolinium-enhanced MRI was Liver Acquisition with Volume Acceleration (LAVA). It took 8 seconds to complete single arterial or venous phase, and the triple arterial and portal venous phase dynamic MRI was performed in two breath-holds. The phase-intensity curve and enhancement parameters (positive enhancement integral (PEI), maximum slope of increase (MSI), maximum slope of decrease (MSD)) of region of interest (ROI) were obtained automatically in workstation. The shape of curve were analyzed and the enhancement parameters were compared followed by independent-samples t test, the difference was significant when  $p < 0.05$ .

## Results

In HCCs, enhancement was slight or minimal in 5 cases, enhancement increased with time, with maximum enhancement in portal venous phase in 14 cases and enhancement increased rapidly with rapid decrease in portal venous phase in 16 cases. In benign lesions, none was slight or minimal enhanced. The enhancement of 4 FNHs (3 patients) increased rapidly with rapid decrease in portal venous phase, 11 hemangiomas and 1 FNH had the curves whose enhancement increased with time, with maximum enhancement in portal venous phase (table 1). The PEI, MSI and MSD of HCCs and benign lesions were  $150.25 \pm 53.56$  and  $185.50 \pm 44.76$ ,  $177.68 \pm 84.81$  and  $236.37 \pm 95.87$ ,  $50.74 \pm 51.29$  and  $37.37 \pm 33.05$ , respectively (table 2). In these parameters, the difference of PEI and MSI was significant ( $p < 0.05$ ). The area under ROC curve of PEI and MSI were 0.718 and 0.705, respectively ( $p < 0.05$ ). When PEI value of 156.05 was chosen, the sensitivity and specificity of diagnosis were 81.3 % and 63.6%, respectively. When MSI value of 195.57 was chosen, the sensitivity and specificity of diagnosis were 62.5% and 66.7%, respectively.

## Conclusion

There are different MR dynamic enhancement patterns in HCCs and hepatic benign focal hypervascular lesions. The positive enhancement integral and maximum slope of increase of hepatic hypervascular benign focal lesions are higher than those of malignant ones, indicating different perfusion characteristics based on different pathologic architectures, which is helpful to differentiate these lesions.

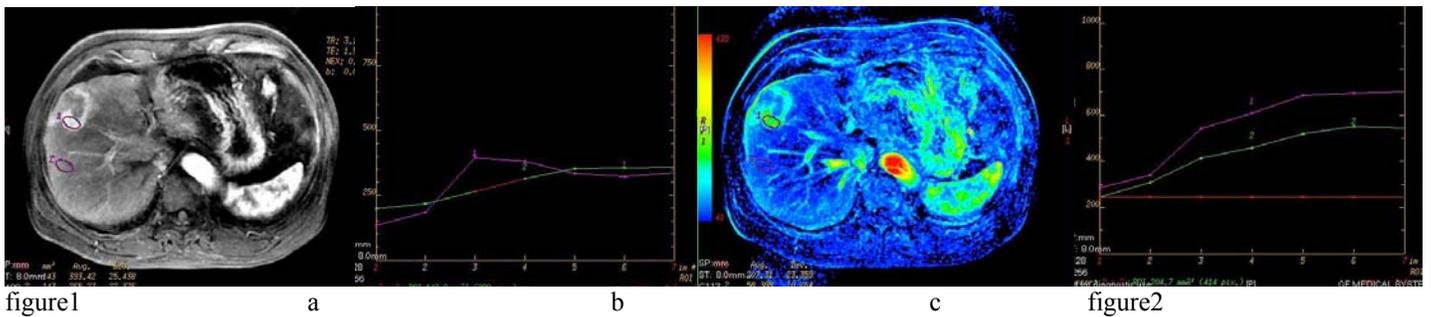


Figure1: A 68-year-old man with pathologically proved HCC.

1a shows the ROIs of the tumor parenchyma (1) and peritumor hepatic tissue (2), and 1b is the dynamic curve accordingly, the enhancement curve of HCC increased rapidly with rapid decrease in portal venous phase. 1c is the parameter map of maximum slope of increase.

Figure 2 The dynamic curve of a pathologically proved FNH (curve1) and relatively normal hepatic tissue (curve 2). The enhancement of FNH increased with time, with maximum enhancement in portal venous.

Table1 The type of dynamic curve of malignant and benign lesions

Type of curve	HCC	hemangioma	FNH
1	5	0	0
2	14	11	1
3	16	0	4

Note:1: slight or minimal enhancement

2::enhancement increased with time, with maximum enhancement in portal venous phase

3: enhancement increased rapidly with rapid decrease in portal venous phase

Table2 The enhancement parameters of malignant and benign lesions

Type of lesions	PEI	MSI	MSD
Malignant	$150.25 \pm 53.56$	$177.68 \pm 84.81$	$50.74 \pm 51.29$
Benign	$185.50 \pm 44.76$	$236.37 \pm 95.87$	$37.37 \pm 33.05$