

Clinicopathological significance of the peritumoral decreased uptake area of Gd-EOB-DTPA in hypervascular hepatocellular carcinoma: Novel application of Gd-EOB-DTPA-enhanced MRI

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Introduction

Gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB-DTPA) is a liver-specific contrast agent taken up specifically by hepatocytes. Many hypervascular hepatocellular carcinomas (HCCs) show well-demarcated hypointensity in the hepatobiliary phase of Gd-EOB-DTPA-enhanced MRI [1]. Because arterial enhancing pseudolesions (AEPs), including arterioportal (AP) shunts, have intact hepatocyte function, most of them show iso-intensity in the same phase imaging [2]. Therefore, Gd-EOB-DTPA-enhanced MRI enabled us to distinguish between HCC and AEP with ease. However, some AEPs have been reported to show hypointensity in the hepatobiliary phase [1, 2]. In daily practice, we also encounter a faint hypointensity in the noncancerous tissue around HCC, which we have designated the peritumoral decreased uptake area of Gd-EOB-DTPA. This type of “pseudolesion” has never been discussed until now. The purpose of this study was to elucidate the significance of the peritumoral decreased uptake area of Gd-EOB-DTPA in the hepatobiliary phase by comparison with clinical and pathological findings of surgically resected HCCs.

Materials and Methods

This study group consisted of 61 patients with 61 surgically resected, hypervascular HCCs, who underwent preoperative Gd-EOB-DTPA-enhanced MRI. MR imaging was performed on a whole-body 1.5 Tesla scanner (Intera Achieva Nova Dual; Philips Medical Systems, Best, Netherlands). A multiphase dynamic study was performed using axial 3D THRIVE (three-dimensional T1 high-resolution isotropic volume excitation). The detailed imaging parameters were as follows: SENSE body coil, TR/TE/FA=3 ms/1 ms/20°, matrix 224 x 116, FOV 36 cm, RFOV 75%, SENSE factor 1.3, slice thickness/gap=4mm/-2 mm, centric k-space ordering, SPIR, acquired 80 sections, scan time 18 sec, and breath-holding. The timing of the arterial dominant phase was determined with a test injection method, and the scanning of the portal, late and hepatobiliary phases began at the arterial dominant phase +30 seconds, 90 seconds and 20 minutes after injection of the contrast agent, respectively. The presence of a faint and hypointense area around the tumor in the hepatobiliary phase was assessed and was defined as the peritumoral decreased uptake area of Gd-EOB-DTPA (PDUAE). The frequency with which PDUAE was seen was compared between pairs of groups divided based on clinical and pathological parameters, including gender, age, infection with hepatitis virus, Child Pugh grade, AFP, PIVKA-II, background liver, tumor location, maximal diameter, growth pattern, capsule formation, septum formation, serosal invasion, the most predominant histological grade, architectural characteristics, vascular invasion and intrahepatic metastasis. Vascular invasion included “microscopic” portal and/or hepatic venous invasion except for one HCC.

Results

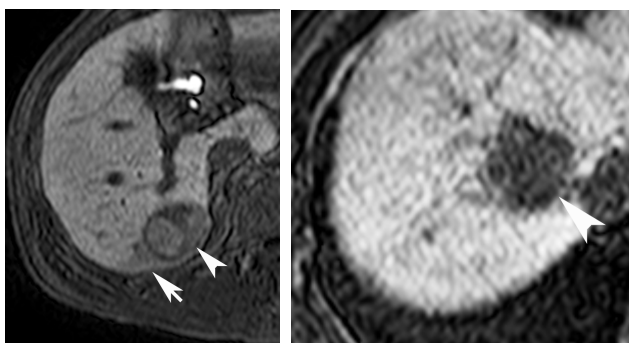
In a Fisher’s exact probability test, the values of AFP and PIVKA II, maximal diameter, the presence of a capsule and vascular invasion were significantly correlated with the frequency with which PDUAE was seen. In a multivariate nominal logistic analysis, only maximal diameter and vascular invasion were significantly correlated. When the presence of PDUAE was used as an indicator of vascular invasion, the sensitivity, specificity, accuracy, positive predictive value and negative predictive value were 72%, 80.6%, 77%, 72% and 80.6%, respectively.

Conclusion

The maximal diameter of a tumor and the presence of vascular invasion were associated with PDUAE. By using this indicator, “microscopic” vascular invasion can be easily predicted with Gd-EOB-DTPA-enhanced MRI.

References

[1] Sun HY, et al. Invest Radiol 2010;45:96-103.2. [2] Motosugi U, et al. Radiology 2010;256:151-158.



(A)

(B)

Figure

(A) Moderately differentiated HCC with microscopic vascular invasion (arrowhead). The hepatobiliary phase of Gd-EOB-DTPA-enhanced MRI showed a faint hypointense area around the tumor (arrow), which represented the peritumoral decreased uptake area of Gd-EOB-DTPA.

(B) Moderately differentiated HCC without vascular invasion (arrowhead). The hepatobiliary phase of Gd-EOB-DTPA-enhanced MRI showed no hypointense area around the tumor such as might represent a peritumoral decreased uptake area of Gd-EOB-DTPA.