

Hypovascular nodules presented with hypointensity on the hepatobiliary phase of Gd-EOB-DTPA enhanced MRI in the cirrhotic liver: Implications for developing hypervascular hepatocellular carcinoma.

T. Hyodo^{1,2}, M. Okada¹, Y. Kagawa¹, S. Kogita³, S. Kumano¹, I. Imaoka¹, M. Hori⁴, K. Ishii¹, Y. Imai³, T. Mochizuki², M. Kudo⁵, and T. Murakami¹

¹Radiology, Kinki University Faculty of Medicine, Osaka-Sayama, Osaka, Japan, ²Diagnostic and Therapeutic Radiology, Ehime University Graduate School of Medicine, Toon, Ehime, Japan, ³Gastroenterology, Ikeda Municipal Hospital, Ikeda, Osaka, Japan, ⁴Radiology, Osaka University Graduate School of Medicine, Suita, Osaka, Japan, ⁵Gastroenterology and Hepatology, Kinki University Faculty of Medicine, Osaka-Sayama, Osaka, Japan

Purpose: To clarify the significance of hypovascular nodules presented with hypointensity on hepatobiliary phase of Gd-EOB-DTPA enhanced MRI (EOB-MRI) in screening for hepatocellular carcinoma (HCC) in the cirrhotic liver.

Materials and methods: In 140 patients who underwent EOB-MRI for known or suspected HCC at least twice, 122 hepatic nodules in 54 patients which showed both hypo-intensity on hepatobiliary phase and hypovascular appearance on arterial phase were reviewed. Arterial and hepatobiliary (at 20 min post injection) phases were obtained after bolus EOB injection (0.1mL/kg, a rate of 2mL/sec) using 1.5 T or 3T MRI. The tumor diameters (sizes) of nodules were measured on hepatobiliary phase images of the initial and final EOB-MRI (mean interval, 338 days; range, 76-860 days). The growth rate (GR) of the nodules was defined as the inverse of tumor volume doubling time (TVDT) in order to perform receiver operating characteristic (ROC) curve analysis. Nodules were categorized into 2 groups: Arterial hypervascularization, assumed to be a development into hypervascular HCC, was observed (group A) or not (group B) with any of imaging modalities during the observation period. The initial sizes and GRs of the nodules were compared between the 2 groups.

Results: Of the 54 patients, 25 (46%) were found to have arterial hypervascularization during the observation period (mean, 280 days; range, 91–697 days). Thirty-nine (32%) of the 122 nodules with arterial hypervascularization were confirmed by EOB-MRI in 33, by dynamic CT in 4, by contrast-enhanced ultrasonography in one, and by CT hepatic arteriography in one. The mean initial size of all nodules was 10mm (range, 3-34 mm); no significant difference between the groups A and B was found ($p=0.68$). All nodules with interval shrinkage were in group B. The GRs in group A were significantly higher than in group B ($p=1.9 \times 10^{-8}$) (Figure 1). Analysis of the ROC curve ($A_z=0.88$, Figure 2) revealed that the cut-off value for arterial hypervascularization was $GR\ 2.8 \times 10^{-3}$ (TVDT=355 days; e.g. final/initial size for interval of 6 months=1.19); Positive predictive and negative predictive values were 82% and 80%, respectively.

Conclusion: The incidence of arterial hypervascularization from hypovascular nodules presented with hypointensity on the hepatobiliary phase of EOB-MRI was 32%. Patients with higher GR may have potential arterial hypervascularization, and GR of $>2.8 \times 10^{-3}$ (TVDT of <355 days) may justify follow-up at short intervals.

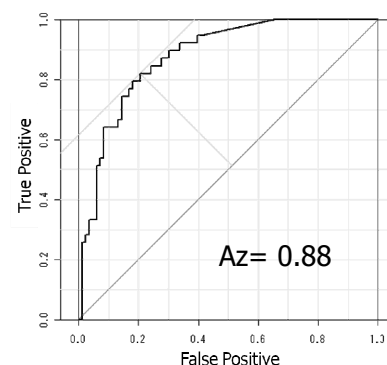
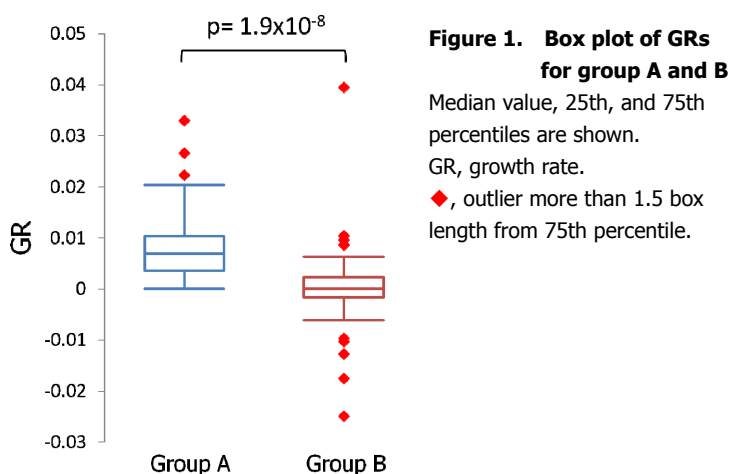


Figure 2. ROC curve of GRs for predicting hypervascularization
The curve shows the cutoff value to be $GR\ 2.8 \times 10^{-3}$ (i.e. tumor volume doubling time 355 days).