

Free-breathing and high b-value Diffusion-weighted MR images of hepatic cavernous hemangiomas

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[Introduction] Cavernous hemangioma is a common benign tumor of the liver and correct diagnosis based on imaging findings is important to avoid excessive surgical intervention. Hemangiomas may show very high intensity similar to cysts on T2-weighted images and characteristic contrast-enhancement pattern on dynamic study, or uptake of superparamagnetic iron oxide (SPIO) agents is diagnostic. The purpose of this study is to evaluate hepatic hemangiomas by free-breathing and high b-value diffusion-weighted images (DWI), and corresponding isotropic ADC maps to differentiate hemangiomas from cysts without the administration of contrast medium.

[Materials and Methods] Forty-five hepatic hemangiomas in thirty patients and forty-five hepatic cysts in forty patients, which were diagnosed by dynamic CT, dynamic MRI or SPIO-MRI, were evaluated. Free-breathing DWI with high b-value ($b=800 \text{ sec/mm}^2$) was performed in all subjects with a spin-echo, single-shot EPI sequence on a system with a 1.5-T superconducting unit (Signa Excite, General Electric, Milwaukee, WI) with 8ch body-array torso coils. The parallel image-encoding techniques (the array spatial sensitivity encoding techniques: ASSET, General Electric, Milwaukee, WI) were employed. Signal intensity on DWI (black and white inversion) was visually evaluated by three radiologists. The isotropic apparent diffusion coefficients (ADCs) of the pathologies and hepatic parenchyma were measured from ADC maps.

[Results] Forty-one of the forty-five hemangiomas (91%) showed high signal intensity (Fig. 1) and the other four hemangiomas (9%) showed iso signal intensity compared with the liver parenchyma on DWI. All forty-five cysts showed iso to low signal intensity compared with the liver parenchyma on DWI (Fig. 2). Two relatively large hemangiomas (maximum diameters were 40 and 60 mm) showed homogeneous high signal intensity on T2-weighted images and inhomogeneous signal intensity on DWI, which may reflect intra-lesional inhomogeneity of ADC. The ADC in normal hepatic parenchyma measured in eight patients was $1.1 \pm 0.08 \times 10^{-3} \text{ mm}^2/\text{sec}$. The ADC in forty-five hemangiomas was $1.94 \pm 0.45 \times 10^{-3} \text{ mm}^2/\text{sec}$., and the ADC in forty-five cysts was $3.32 \pm 0.44 \times 10^{-3} \text{ mm}^2/\text{sec}$. ($0.0001 > p$). (Table 1) The ADC in forty-one high intense hemangiomas on DWI was $1.92 \pm 0.46 \times 10^{-3} \text{ mm}^2/\text{sec}$., and the ADC in four iso intense hemangiomas on DWI was $2.13 \pm 0.39 \times 10^{-3} \text{ mm}^2/\text{sec}$. ($p > 0.05$).

[Conclusion] Free-breathing and high b-value DWI may be useful for the diagnosis of hepatic hemangiomas in differentiation from cysts without the administration of contrast medium. Hepatic hemangiomas may show very high intensity on T2-weighted images and high intensity on DWI. The ADC values may be helpful for the diagnosis of hemangiomas which do not show high signal intensity on DWI.

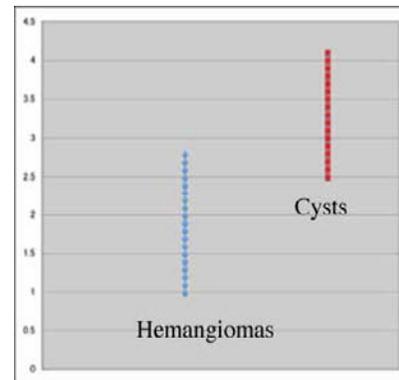
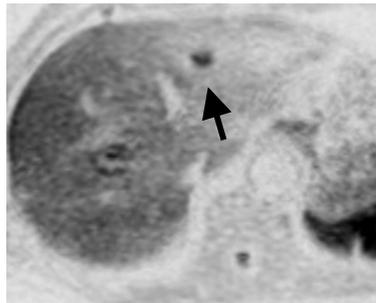
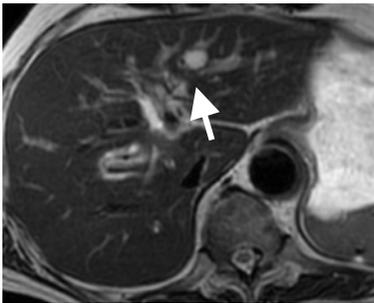


Fig. 1: Hepatic hemangioma (left: T2-WI, right: DWI; black and white inversion)

Table 1: The ADCs of Hemangiomas and Cysts

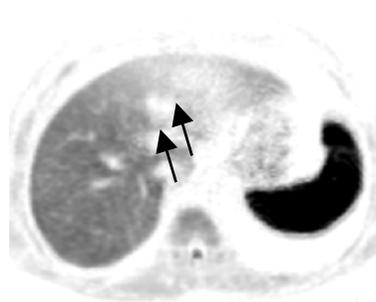
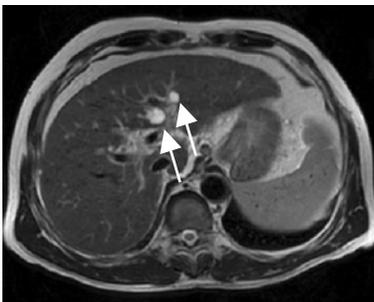


Fig. 2: Hepatic cysts (left: T2-WI, right: DWI; black and white inversion)