

Detection of colorectal liver metastases : sensitivity of T2-weighted and diffusion-weighted imaging using histopathological examination as method of reference in a rat model.

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Introduction:

Colorectal liver metastases are frequent and the only curative treatment is surgery. Early and accurate liver metastases detection at MRI is a key point to improve surgery rate and global survival. Diffusion-weighted (DW) imaging is considered to improve the detection of liver metastases relative to conventional MRI, but no studies with correlations to histopathological examination of the whole liver has been performed to prove this (1, 2). The purpose of this study with precise histopathological correlations was to compare the sensitivity of T2-weighted and DW imaging in detecting colorectal liver metastases in a rat model.

Methods and Materials:

Eighteen BDIX rats had surgery with 4 injections of 0.5 million DHDK12 cells in the left liver. MR examination included RARE T2-weighted imaging and SE-DW imaging ($b = 0, 20$ and 150 s/mm^2), with a $600 \mu\text{m}$ isotropic resolution. Sacrifice was performed immediately after the MRI procedure. Images were analyzed by two independent readers. Pathological examination was performed after slicing the whole left liver every 0.4 mm . Average diameter of each liver metastasis was computed. Cochran Q-test was used to compare the detection rates. Interobserver agreement for liver metastases detection was assessed using κ coefficients.

Results:

A total of 166 liver metastases were identified on pathological examination. Mean average diameter was $1.05 \pm 0.8 \text{ mm}$. For both readers, a significantly higher number of metastases was detected on DW imaging than on T2-weighted imaging ($99/166$ (60%) versus $77/166$ (46%), $p < 0.001$ for reader 1 and $92/166$ (55%) versus $77/166$ (46%), $p = 0.001$ for reader 2). After stratification according to metastasis average diameter, DW imaging had a significantly higher detection rate than T2-weighted imaging for metastases with a diameter between 0.3 and 1.2 mm ($42/78$ (54%) versus $24/78$ (31%), $p < 0.001$ for reader 1 and $36/78$ (46%) versus $24/78$ (31%), $p = 0.001$ for reader 2). No difference was found between the two imaging techniques for metastases smaller than 0.3 mm ($2/32$ (6%) vs. $0/32$ (0%), $p = 0.157$ for both readers). or larger than 1.2 mm ($55/56$ (98%) vs. $53/56$ (95%), $p = 0.157$ for reader 1 and $54/56$ (96%) vs. $53/56$ (95%), $p = 0.564$ for reader 2). There was an excellent agreement between the two readers. Cohen κ coefficients were 0.952 for T2-weighted imaging and 0.865 for DW imaging ($p < 0.001$).

Discussions and Conclusion:

This small animal study with precise MR and histopathological correlations shows the better sensitivity of DW imaging relative to T2-weighted imaging for detecting liver metastases, especially those of small size.

References

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2. Coenegrachts K, Delanote J, Ter Beek L, et al. Improved focal liver lesion detection: comparison of single-shot diffusion-weighted echoplanar and single-shot T2 weighted turbo spin echo techniques. *Br J Radiol.* 2007;80(955):524-31.

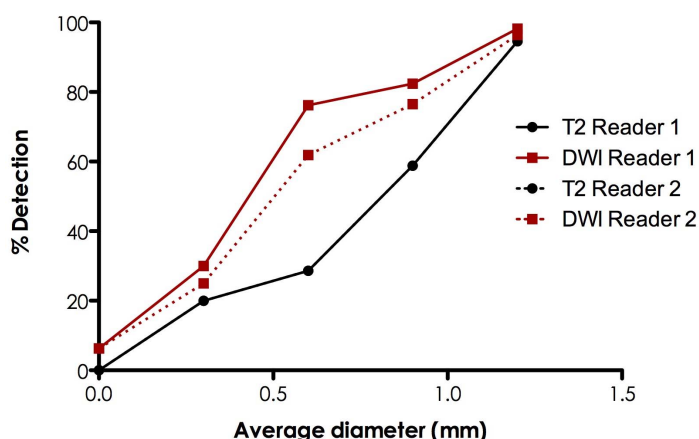


Figure 1: Detection rate according to liver metastases average diameter

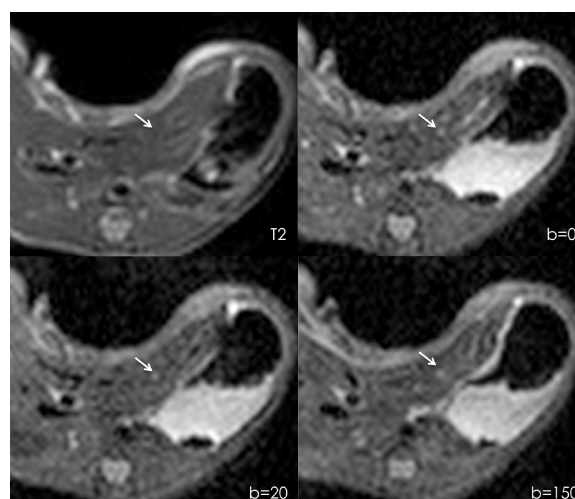


Figure 2: Example of liver metastasis diagnosed only on DW imaging