Detection of focal malignant liver lesions: comparison of T2-weighted and diffusion-weighted imaging at 1.5T or 3.0T

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Purpose: To compare the efficacy of T2-weighted (T2W) and diffusion-weighted (DW) imaging for detection of focal malignant liver lesions at 1.5T or 3.0T.

Materials and Methods: Thirty-three consecutive patients with focal malignant liver lesions on MR images were included in the study. Among them, nineteen patients were examined at 1.5T and 14 patients at 3.0T. Both T2W and DW imaging were performed on each patient. Transverse fat-suppressed T2W images with respiratory triggering were acquired as FRFSE at 1.5T (TR/TE, 5700-8600/89 ms) and FSE (TR/TE, 6000-8600/102 ms) at 3.0T. DW images were acquired as single-shot echo planar imaging (1.5T b=500 and 0 sec/mm^2; TR/TE, 3000/55 ms; 3.0T b=800 and 0 sec/mm^2; TR/TE, 2300/56 ms). A total of 45 malignant tumors were finally confirmed either by histopathology or combined clinical data, typical imaging features and follow-up studies, including 26 hepatocellular carcinoma, 7 cholangiocellular carcinoma, and 12 metastases. Two observers interpreted T2W and DW images independently and separately in random order without any knowledge of the history and final diagnosis. The signal intensity (SI) of tumors and liver were measured at workstation. The ratio of SI of tumor/liver was calculated on tumors more than 1 cm in diameter and without interference of artifacts. The detection rate of tumors on 1.5T and 3.0T were compared using Chi-square tests, and the detection rate on two sequences and the ratio of SI of tumor/liver were compared using nonparametric tests.

Results: Diagnostic images were obtained in all patients (Fig. 1-2). On both T2W and DW images, there were no significant differences between the detection rate on 1.5T and 3.0T (Tab.1). There was no significant difference (observer1 P=0.227, observer2 P=0.077) between the detection rate on T2W and DW images. When the two sequences were combined together, the detection rate on (DWI+T2WI) was significantly higher (observer1 P=0.008, observer2 P<0.001) than that on DWI alone, however, still not statistically higher (observer1 P=0.250, observer2 P=0.125) than that on T2WI. The kappa value for DWI (0.848) was similar (P=0.482) to that for T2WI (0.544). The ratio of SI of tumor/liver was calculated for 31 tumors (Tab.2). On both T2W and DW images, there were no significant differences between the ratio on 1.5T and 3.0T (T2WI Mann-Whitney U=103, P=0.525; DWI Mann-Whitney U=102, P=0.500). There was no significant difference (Z=-0.451, P=0.652) between the ratio on T2W and DW images, either.

Discussion: Early reports suggested that DWI was useful for increased detection of focal malignant liver lesions [1]. However, Perfusion and T2 "shine-through" effects usually contribute more than diffusion effects to DWI with a small gradient b-factor [2]. The results of our study using large gradient b-factor with high field strength MR units suggested that DWI was not superior to T2WI for detection of focal malignant liver lesions. Lesions seemed easily to be found on DWI perhaps partly due to its background suppression.

Conclusion: There were no significant differences between the performance of 1.5T and 3T in detection of focal malignant liver lesions. T2W and DW imaging was similar in detection of focal malignant liver lesions. Combined with T2WI, the detection rate on DWI can be improved.

References: [1] Ichikawa T, et al. AJR 1998; 170: 397-402. [2] Moteki T, et al. JMRI 2006; 24: 637-645.

Tab.1 Detection rate of tumors

MR	T2WI (%)		DWI (%)	
	Observer1	Observer2	Observer1	Observer2
1.5T	83.33 (20/24)	87.50 (21/24)	70.83 (17/24)	62.50 (15/24)
3.0T	80.95 (17/21)	76.19 (16/21)	71.43 (15/21)	66.67 (14/21)
Total	82.22 (37/45)	82.22 (37/45)	71.11 (32/45)	64.44 (29/45)

Tab.2 The ratio of SI of tumor/liver

MR	T2WI	DWI
1.5T	1.722±0.547	1.705±0.395
3.0T	1.856±0.607	1.908±0.674
Total	1.795±0.575	1.816±0.566

Fig.1 T2W image on 3.0T, the lesion was detected by both observers

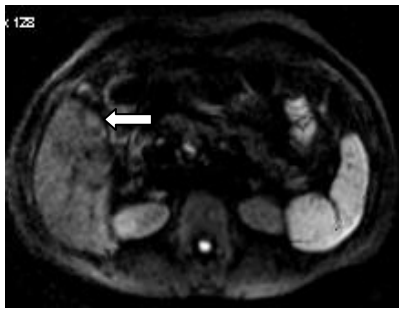

Fig.2 DW image on 3.0T (b=800 sec/mm^2), neither of the observers detected the lesion