Intravoxel Incoherent Motion MR Imaging in Evaluation of Focal Malignant Liver Masses: Compare with Apparent Diffusion Coefficient

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Purpose: It is necessary to indistinguish malignant liver lesions for further treatment or staging by non-contrast technique. To compare the value of ADC and IVIM derived parameters (D, D*, f) in the differentiation of common liver malignant tumors.

Methods: Diffusion Weighted Imaging (DWI) of 53 patients with 85 focal liver masses (47 hepatocellular cancers (HCCs), 18 cholangiocarcinomas, and 20 metastases) were acquired on 3.0T MR scanner with 2 b values (0, 800 s/mm^2) to measure the ADC values and with 7 b values (0, 50, 100, 250, 500, 750, 1000 s/mm^2) to measure IVIM derived parameters: true diffusion coefficient (D), perfusion related diffusion coefficient (D*) and perfusion fraction (f). Means were compared by using the Dunnett multiple comparison test.

Results: Both ADC and D were significantly higher in cholangiocarcinomas than in HCCs (ADC: 1.49±0.27×10^{-3} vs 1.20±0.26×10^{-3} mm^2/s and D: 0.94±0.17×10^{-3} vs 0.53±0.23×10^{-3} mm^2/s, respectively; P = 0.002 and P < 0.001) (table 1), and D provided higher accuracy in this differential diagnosis with areas under the receiver operating characteristic curve (AUROC) of 0.936 and 0.794, respectively (table 2). No ADC and IVIM derived parameters could differentiate metastases from HCCs and cholangiocarcinomas.

Conclusion: Compared with ADC, D could improve the accuracy of differential diagnosis of HCCs and cholangiocarcinomsa.

Discussion: Several studies have claimed that DWI can differentiate between benign and malignant lesions based on ADC measurements(1-5). However, the differences analysis in malignant lesion types in ADC or IVIM derived parameters were not done in these studies. The lower values of D than ADC in all three lesion types in our study might be caused by the less effect of perfusion related diffusion component. The lower D in HCCs than cholangiocarcinomas (P<0.001) and no different D* between the two groups (P=0.924) may present the higher cellular in the former than the latter with the same perfusion character. In conclusion, the diffusion parameters calculated from multi-b DW imaging could promise higher accuracy than regular ADC calculated from two-b DW imaging for the differential diagnosis of HCCs and cholangiocarcinomas, but could not provide additional information for the distinguish of HCCs and cholangiocarcinomas from metastases.

References

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Table 1 The ADCs and IVIM derived parameters measured in HCCs, cholangiocarcinomas, and metastases

Parameters	ADC(×10^{-3}mm^2/s)	D(×10^{-3}mm^2/s)	D*(×10^{-3} mm^2/s)	f(%)
HCC	1.20±0.26	0.53±0.23	7.79±6.75	38±17
cholangiocarcinoma	1.49±0.27	0.94±0.17	8.98±8.10	34±15
metastasis	1.32±0.31	0.72±0.38	6.52±6.21	46±18

Table 2 The *P* values/AUROC of multi-group analysis among HCCs, cholangiocarcinomas and metastases

Comparison	ADC	D	D*	f
HCC vs cholangiocarcinoma	0.002/0.794	0.000/0.936	0.924/0.572	0.722/0.355
HCC vs metastasis	0.405/0.642	0.140/0.670	0.837/0.404	0.261/0.638
cholangiocarcinoma vs metastasis	0.190/0.658	0.088/0.768	0.655/0.650	0.118/0.272