

The application of 3.0T MR intravoxel incoherent motion imaging in diagnosing of rectal carcinoma

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Introduction: To evaluate the clinical value of Intravoxel Incoherent Motion imaging (IVIM) in the diagnosis of rectal carcinoma.

Methods: This study was approved by local institutional review board. Forty-eight patients with rectal carcinoma were included and signed written informed consent forms were obtained. All patients were scanned with IVIM sequence ($b=0, 25, 50, 75, 100, 150, 200, 400, 600, 800, 1000, 1200, 1500$ and 2000 s/mm^2 , TR were 2200 msec, TE was minimum, FOV 260 mm×260 mm, NEX for T2 were 4, matrix were 128×160, using 4-mm slice thickness with a 0.5-mm gap, scan time was 7min13sec) and T2 Cube sequence (TR were 2000 msec, TE was maximum, NEX was 1, using 4-mm slice thickness with a 0-mm gap, FOV 360 mm×360 mm, matrix were 320×320, echo train length were 100, scan time was 3 min 25 sec) on a GE 3.0T whole body scanner. The contrast-to-noise ratios (CNRs) of rectal tumor and normal rectal wall in different b values were calculated and compared [1-2]. The optimization images of IVIM and T2 Cube sequence images in estimating T-staging feature were compared with the pathological results. The standard ADC, D, D* and f values were measured and calculated in IVIM sequence.

Results and Discussion: The CNRs of rectal tumor and normal rectal wall had a decreasing trend when the b values decreased. The CNRs in the IVIM images with $b=25\text{--}1000 \text{ s/mm}^2$ was significantly higher than that in IVIM images with $b=1200 \text{ s/mm}^2$ and T2cube ($F=50.52, p<0.05$). T2 Cube sequence was better than IVIM sequence in estimating the accuracy of T-staging. ($X^2=5.60, p=0.02$) [3-4]. The standard ADC, D, D* and f values of rectal tumor showed significant reduction compared with those of normal rectal wall ($p<0.05$).

Conclusion: IVIM sequence can reveal standard ADC, D, D* and f values of rectal carcinoma, which is useful for demonstrating the pathophysiology process of rectal cancer. The optimal images are shown in $b=800\text{--}1000 \text{ s/mm}^2$, but with the moderate accuracy in T-staging diagnosis.

References: [1] Rao SX et. al., Eur J Radiol, 2008. [2] Hosonuma T et. al., Magn Reson Med Sci, 2006. [3] Ichikawa T et. al., Am J Roentgenol, 2006. [4] C. K. Kim et. al., Am J Roentgenol, 2010.

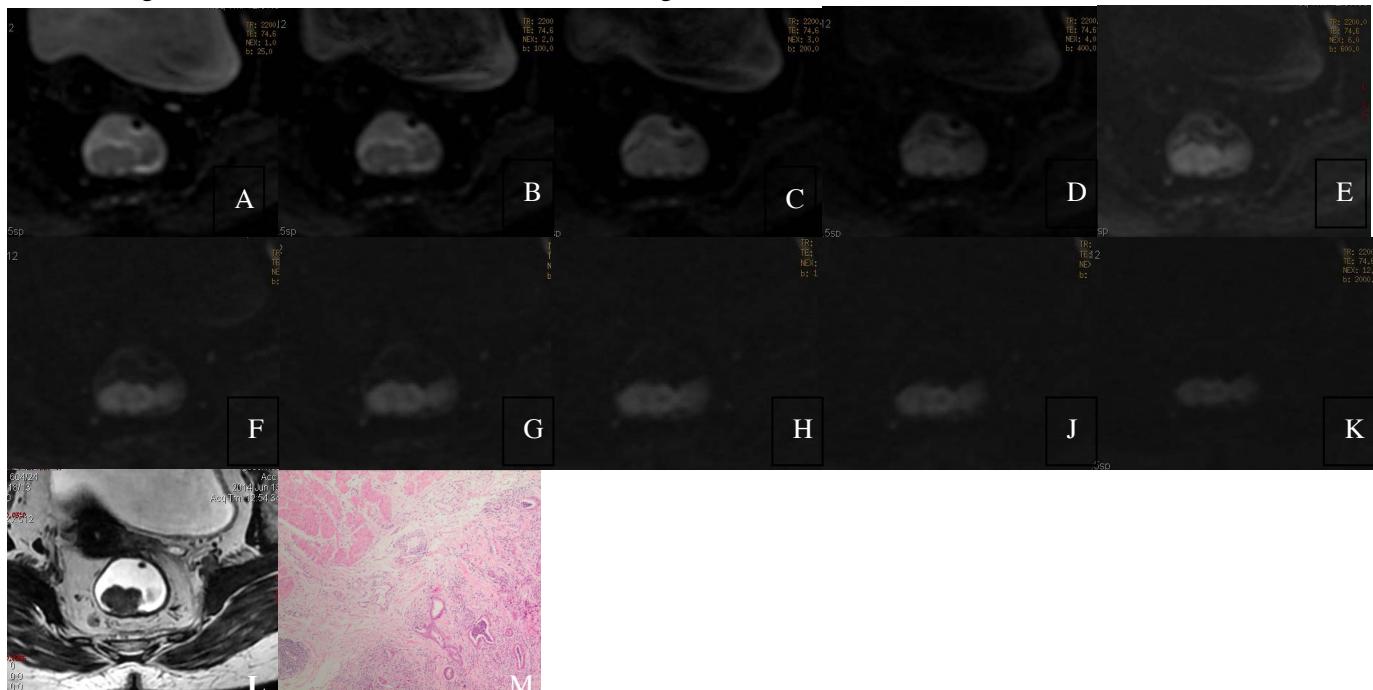


Figure 1. In IVIM images (A-K, $b=25 \text{ s/mm}^2, 100 \text{ s/mm}^2, 200 \text{ s/mm}^2, 400 \text{ s/mm}^2, 600 \text{ s/mm}^2, 800 \text{ s/mm}^2, 1000 \text{ s/mm}^2, 1200 \text{ s/mm}^2, 1500 \text{ s/mm}^2$ and 2000 s/mm^2) the signal of tumor are higher than that of rectal wall, they decreased as b values decreased. Tumor and rectal wall were shown best when b was in $800\text{--}1000 \text{ s/mm}^2$. when b was larger than 1200 s/mm^2 , normal rectal wall signal was decreased, but tumor was still high signal. T1 stage rectal carcinoma (L, T₂ Cube sequence; M, HE stain 40×) Tumor located in mucous and submucous.