

Feasibility and Preliminary Experience of a Diffusional Kurtosis Model for Detection of Rectal cancer

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Target audience

Diagnostic Radiologist, Radiographer, Gastroenterologist, Magnetic resonance Engineer.

Purpose

The primary aim of this prospective study was to compare findings at non-Gaussian diffusional kurtosis imaging and conventional diffusion-weighted MRI as markers of differencing rectal cancer.

Methods

This prospective study was approved by our institutional review board and informed consent. Twenty-four rectal patients underwent 3-T magnetic resonance(Achieva 3.0T TX, Philips Healthcare, Netherlands) scan 2 weeks prior to operation by using DK imaging(5 b values: 0,500,1000,1500,2000;3 diffusion directions) and conventional diffusion-weighted (DW) imaging. Parameters maps displaying standard apparent diffusion coefficient (ADC), kurtosis (K) representing non-Gaussian diffusion behavior, and diffusion (D) representing a diffusion coefficient adjusted for non-Gaussian (kurtosis) behavior were reviewed, and the most abnormal region and normal rectal wall was recorded for each metric. Associations between these metrics and the presence of adverse final pathologic findings were assessed with paired t-tests and receiver operating characteristic(ROC) analyses.

Results

There were 21 adenocarcinomas (20 moderately differentiated and one poorly differentiated), and three mucinous cell carcinomas. Three normal rectal walls were unable to be analyzed for the artifact. ADC, D and K values for carcinomas were as follows: $1.05 \pm 0.26 \times 10^{-3} \text{mm}^2/\text{sec}$, $1.30 \pm 0.27 \times 10^{-3} \text{mm}^2/\text{sec}$, 1.07 ± 0.16 , whereas ADC,D and K for normal wall were $1.38 \pm 0.25 \times 10^{-3} \text{mm}^2/\text{sec}$, $1.80 \pm 0.35 \times 10^{-3} \text{mm}^2/\text{sec}$, 0.83 ± 0.21 , respectively. There was a significant difference between the adenocarcinomas and normal rectal wall ($p=0.001$, 0.000 , 0.001) respectively(Table 1). D had a larger area under the receiver operating characteristics curve (AUC, 0.905) for predicting adenocarcinoma than ADC (AUC, 0.844)(Fig 1), where K had a smallest (AUC, 0.833)(Fig 2).

	Normal Rectal Wall	Adenocarcinomas	d
ADC($\times 10^{-3} \text{mm}^2/\text{sec}$)	1.38 ± 0.25	1.05 ± 0.26	0.001
D($\times 10^{-3} \text{mm}^2/\text{sec}$)	1.80 ± 0.35	1.30 ± 0.27	0.000
K	0.83 ± 0.21	1.07 ± 0.16 ,	0.001

Table 1: Comparison of ADC,D and K values between adenocarcinoma and normal rectal wall(N=21)

Discussion

In this study, we found the metric ADC and D value were significantly lower in the presence of predicting adenocarcinoma, where the metric K value was significantly greater in the presence of predicting adenocarcinoma . In addition, the metric D had a larger AUC for predicting adenocarcinoma than ADC, this was similar to previous studies that diffusional kurtosis imaging findings may have more value than findings at conventional diffusion-weighted MRI in tumour. But the metric K had the smallest AUC contrast with recent researches.

That may be K is a parameter which defines the degree of water distribution that away from Gaussian distribution, hence the metric K is greatly influenced by the intestinal peristalsis, for Antispasmodic is not used in this study. Another reason may be the sample size of this study was too littler.

Conclusion

Preliminary findings suggest that DK imaging is able to predict adenocarcinoma from normal rectal wall. The metrics obtained from DKI suggest increased value compared with standard DWI.

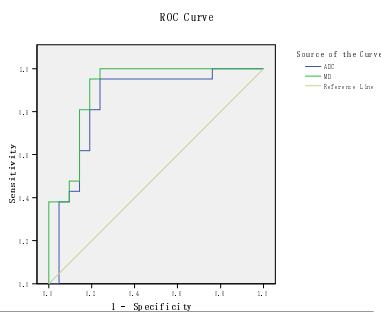


Fig1-Receiver operating characteristic curves show ADC and D in discrimination of predicting adenocarcinoma from normal rectal wall. AUC was 0.844 for ADC, 0.905 for D.

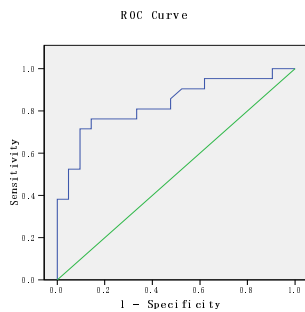


Fig2-ROC curves show K in discrimination of predicting adenocarcinoma from normal rectal wall. AUC was 0.833.