Reproducibility of Diffusional Kurtosis Imaging measurement in uterine cervix in vivo

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TARGET AUDIENCE: Our abstract would be of general interest to most radiologists, and particularly to researchers who are studying on DK imaging and cervical carcinoma. Meanwhile, it is useful to clinical doctors especially for those in Gynecological Oncology department. **PURPOSE:** The purpose of this study is to evaluate the reproducibility of Diffusional Kurtosis Imaging in uterine cervix in vivo. **Materials and Methods:** This prospective study was approved by our institutional review board and informed consent. Twenty healthy volunteers underwent 3-T magnetic resonance imaging(Philips Healthcare) twice with an interval of 24 hours to 14 days by using axial fat suppressed single-shot echo-planar DK imaging(five b values) and torso phased-array coil. Parameters maps were obtained for the metric K and corrected diffusion (D). The intra- and inter-observer consistencies were evaluated by using reliability test and Bland-Altman analysis in SPSS 19.0. **Results:** A total of 20 volunteers underwent the scans, providing 40 data points for DK imaging. No data was excluded. The K and D values measured by two radiologists respectively showed in Table1. Paired t-tests demonstrate no significant difference between paired observers and paired scans (all P>0.05). Intra-class correlation coefficient (ICC) and the average coefficient of variation(CV) results in intra-observer and short-term reproducibility were of a high level(Table 2). Bland-Altman analyses showed that all data points from the intra- and inter-observer consistency were located within the limits of consistency, while 20.6% of intra-observer K reproducibility beyond the limit of consistency. **Discussion:** Both ICCs and CVs indicate that the reliability test for reproducibility (ICCs) is fairly good. However, CV of parameter K is obviously higher than that of D. That is because K is a parameter which defines the degree of water distribution that away from Gaussian distribution. Generally, in normal cervix tissue, the changes of cervical muscle fibers' direction would cause the changes of tissue's anisotropy, hence the diffusion of water molecules were greatly affected by the direction of cervical muscle fiber. **Conclusion:** DK imaging appears reproducible in providing useful information of non-Gaussian diffusion behavior in uterine cervix. Knowledge of the variability of the DK parameters is important to guide appropriate experimental design and statistical consideration in future experimental studies. The parameters D and K would be the foundation of further experiments and clinical application of DK imaging.

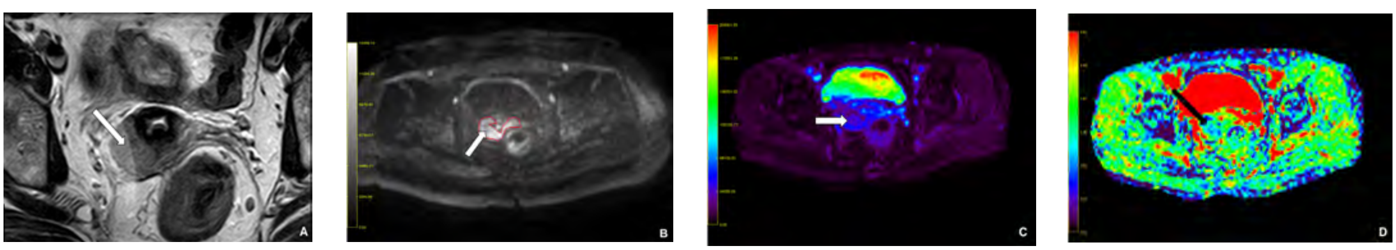

Figure1: Data in 59-year-old woman with cervical squamous cell carcinoma. A, Axial T2 image shows the region of lesion and the increased T2 signal in lesion area (white arrow). B, Axial DWI (b=1000) shows the increased DWI signal intensity (white arrow) in lesion area (red curve) with high b value. C, D map, constructed by using a non-Gaussian kurtosis model, shows the decreased D value (white arrow). D, K map, shows increased signal intensity (K value) in this region (black arrow).

Table1. D and K values of the subjects measured by two radiologists respectively (n=20, $\bar{x} \pm s$)

Scan	D （$\times 10^{-3} mm^2/sec$)		K	
	Radiologist 1	Radiologist 2	Radiologist 1	Radiologist 2
The first scan	1.802±0.259	1.822±0.258	0.944±0.178	0.929±0.160
The second scan	1.829±0.243	1.808±0.214	0.931±0.156	0.946±0.135

Table2. intra- and inter-observer consistency and variability

Scan	ICC	95%CI	CV
Intra-observer D	0.857	0.619-0.922	18.3%
Inter-observer D	0.864	0.609-0.964	17.7%
Intra-observer K	0.825	0.563-0.906	21.3%
Inter-observer K	0.843	0.537-0.965	18.8%