Evaluation of urinary bladder cancer on synthetic FOCUS diffusion weighted imaging

Motoyuki Katayama[1], Takayuki Masui[1], Kimihiko Sato[1], Kei Tsukamoto[1], Kenichi Mizuki[1], Maho Hayashi[1], Tetsuya Wakayama[2], and Yuji Iwadate[2]

[1]Radiology, Seirei Hamamatsu General Hospital, Hamamatsu, Shizuoka, Japan, [2]GE Healthcare Japan, HIno, Tokyo, Japan

Target audience:

The scientists, physicians, and technologists who are interested in Diffusion-weighted images for urinary bladder cancer.

Introduction:

MR imaging has played an important role in evaluating the urinary bladder cancer. Now, diffusion weighted imaging (DWI) with single-shot echo planar imaging (ss-EPI) is a useful tool for detection of the intra-pelvic tumor. However, DWI with ss-EPI is susceptible to inhomogeneity of the main magnetic field and may result in distortion of imaging. Field-of-view (FOV) optimized and constrained undistorted single-shot (FOCUS) is one of the new methods. With this method, we can decrease the required readout duration for single shot EPI by using a 2D spatially selective echo-planar RF excitation pulse and a 180 degrees refocusing pulse, consequently, and can acquire high spatial resolution images with less distortion (Figure.1). On the other hand, synthetic DW Imaging (S-DWI) is a new method that can calculate DWIs for any b-value from at least two DWIs using different b-values. The purpose of this study is to compare delineation of urinary bladder cancers in FOCUS-DWI and synthetic FOCUS-DWI (S-FOCUS-DWI) with those in conventional FOV DWI.

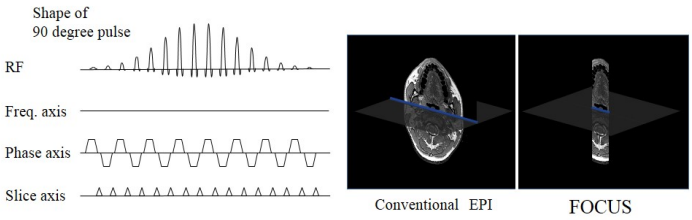

Figure 1. Sequence chart of FOCUS EPI DWI

Materials and Methods:

39 patients with 52 urinary bladder cancers were included in this study, who underwent MRI on a 3T unit (MR750, MR750W, GE Healthcare) before surgery. The spatial resolution of FOCUS DWI was as follows; FOV: 24*12cm, Matrix: 128*64, section thickness: 4-5 mm, and that of conventional DWI was as follows; FOV: 40*28 cm, Matrix 128*160, section thickness: 4-5 mm, respectively. The b-value of FOCUS imaging was 800, and that of conventional DWI was 1500. S-DWI with b-value of 1500 calculated from FOCUS with that of 800. Apparent diffusion coefficient (ADC) of the tumor in each imaging was calculated with FUNCTOOL (GE Healthcare). Diagnostic performance of T stage was evaluated in S-FOCUS-DWI and conventional FOV DWI. Qualitative evaluations (overall image quality, image undistorsion, blur, motion artifact, conspicuity of tumor, and tumor structural visualization in same magnification, respectively) were performed with five-point scale.

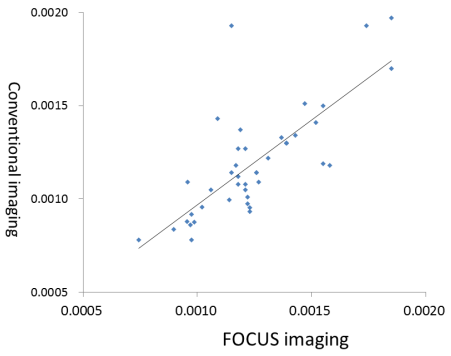

Figure 2. ADC of tumor in each imaging

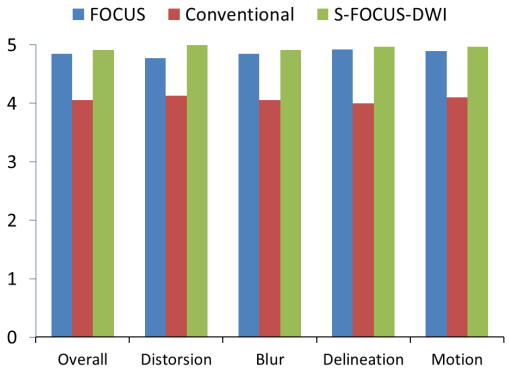

Figure3. Qualitative analysis

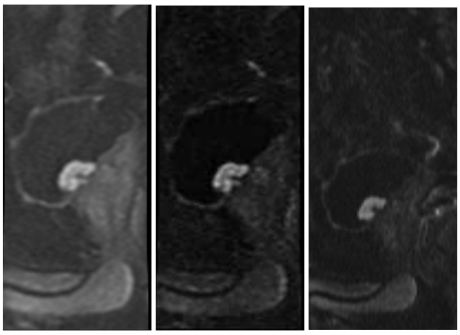

Figure 4. 60-year old man with T1-stage bladder tumor
FOCUS DWI (left image) and S-DWI from FOCUS shows tumor in higher spatial resolution than

Results:

Correlation Coefficient (R) of calculated ADC of tumor between in FOCUS imaging and in Conventional imaging was 0.75 (Figure 2). Figure 4 shows the images of FOCUS and conventional DWI. The sensitivity and the specificity of each imaging were as follows: FOCUS-DWI; sensitivity/ specificity: 70%/100%, conventional FOV DWI; 40%/100%, S-FOCUS-DWI; 100%/100%, respectively. Figure 3 is the qualitative analysis of each imaging.

The image quality of S-FOCUS-DWI was equal to that of FOCUS and was superior to that of conventional-FOV DWI.

Conclusion:

FOCUS DWI is useful for evaluation of urinary bladder carcinoma with high spatial resolution and less distortion.

S-DWI is able to enhance diagnostic ability of FOCUS without image degradation, and might be one of the best combinations.

Reference:

Saritas EU, Cunn ingham CH, et al. Magn Reson Med. 200 8 Aug;60(2):468-73