High Resolution Diffusion Weighted Imaging of Pancreatic neoplasms using 2D ss-rFOV-DWEPI at 3 Tesla

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TARGET AUDIENCE: Researchers in the field of High Resolution MRI or pancreatic Diffusion weighted MRI.

INTRODUCTION:

High resolution Diffusion Weighted Imaging and exact measurement of apparent diffusion coefficient (ADC) values would help improve the diagnostic accuracy in various diseases especially for the pancreatic tumors.[1] DWI has been mostly acquired using single-shot echo-planar imaging (ss EPI) to minimize motion induced artifacts. The spatial resolution, however, is inherently limited in ss EPI, even with the advances in parallel imaging.[2] A novel method of reduced Field of View ss EPI (rFOV ss EPI) has achieved high resolution DWI in human carotid artery, spinal cord with reduced blurring and higher spatial resolution than conventional ss EPI.[3-5] In the study, we optimized the rFoV technique and compared with standard ss EPI in terms of image quality, apparent diffusion coefficient (ADC) values, to demonstrate the feasibility of pancreatic high resolution rFOV DWI.

MATERIALS AND METHODS:

A home-made phantom filled with copper sulfate doped water (0.2 % in mass fraction of CuSO4•5H2O, 650 ml) and canola oil (550 ml) was imaged with T2WI, ss EPI (b value = 600 s/mm^2, TE = 66 ms, TR =4000 ms, FOV = 24 × 24 cm^2, matrix = 128 × 128) and rFOV ss EPI (b value = 600 s/mm^2,TE = 56.5 ms, TR =4000 ms, FOV = 14 × 4.2 cm^2, matrix = 128 × 64) to demonstrate the results of reducing the FOV and suppressing the signal from fat with an 8 channel body-phased array coil using 2D rFOV ss-DW EPI in a 3.0 Tesla MR scanner.

7 healthy volunteers and 10 patients who were pancreatic adenocarcinoma with histopathologic diagnosis (5 Ductal adenocarcinomas, 2 Endocrine neoplasms, 1 Solid pseudopapillary neoplasm, 1 intraductal papillary mucinous neoplasm and 1 Serous cystadenoma) were recruited. All the 17subjects were prospectively examined with 2D rFOV ss-DW EPI (FOV = 16 × 8.0 cm^2, matrix = 128 × 64) and ss EPI (FOV = 38 × 38 cm^2, matrix = 128 × 96) using b = 600 s/mm^2.

A observer rated subjective image quality in b value = 0 and 600 s/mm^2 (maximum scores 4) separately, and a separate observer placed ROI within the pancreas or solid lesions to measure ADC. A series of Paired Wilcoxon tests were used to compare abdominal DWI, ADC between ss EPI and rFOV ss EPI.

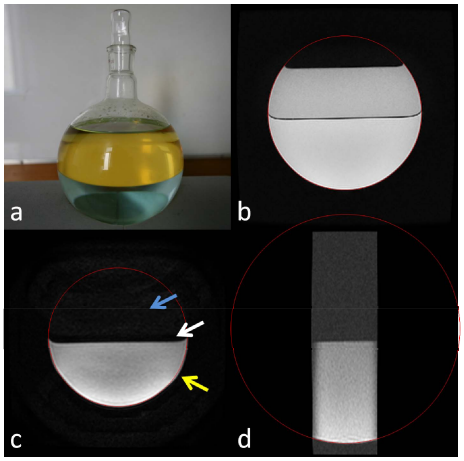

Figure 1. Water/fat phantom (a) and MRI results (b T2WI, c ss EPI with fat suppression and d rFOV DWI with fat suppression)

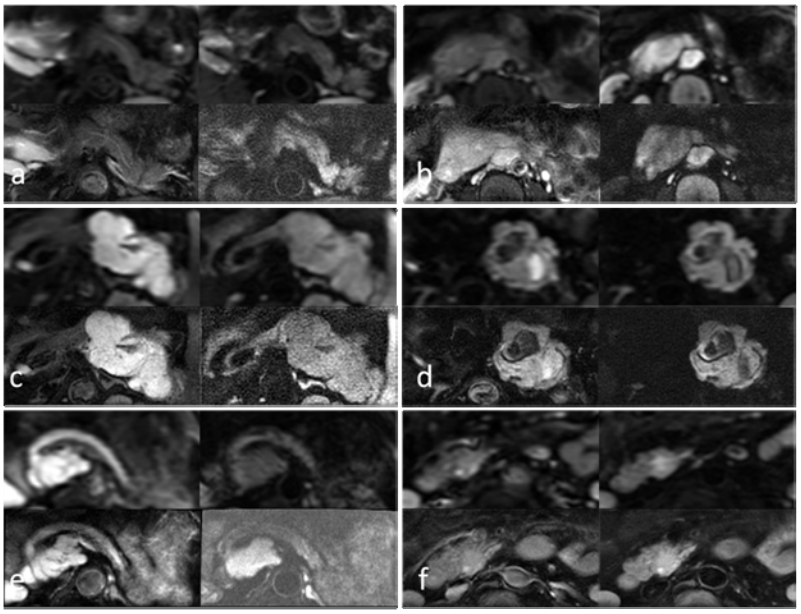

Figure 2. ss EPI and rFOV EPI of pancreas (b = 0 and 600 s/mm^2). a, healthy pancreas; b, Endocrine neoplasm; c, Serous cystadenoma; d, Solid pseudopapillary neoplasm; e, intraductal papillary mucinous neoplasms and f, Ductal adenocarcinoma

RESULTS:

Both phantom experiment and in vivo imaging results show the images of rFOV DWI to achieve a reduced FOV excitation. There is no outer volume excitation, without obvious artifacts and fat suppression is successfully achieved by an eight-element phased array body coil in a high magnetic field of 3.0 Tesla(Figure 1).

Subjective image quality was significantly higher at rFOV ss EPI for comparisons both at b value = 0 s/mm^2 (P = 0.000) and b values = 600 s/mm^2 (P = 0.008). ADC values were similar at ss EPI and rFOV ss EPI for normal pancreas using b = 600 s/mm^2 (P = 0.611).

CONCLUSIONS:

The high resolution rFOV DWI of pancreas can be achieved in a modern high field (3.0) MR scanner. Compared with ss EPI, rFOV ss EPI provided generally similar ADC values, and higher image quality. It is hopeful to show more information of various pancreatic tumors in the high resolution DW images to be of benefit to the early diagnosis and therapeutic evaluation of pancreatic disease.

REFERENCES:

1. Wang Y, Miller FH, Chen ZE, et al. RadioGraphics 2011; 31:E47–E65. 2. Farzaneh F, Riederer SJ, Pelc NJ. Magn Reson Med 1990; 14:123–39. 3.Yuan J, Zhao TC, Tang Y, et al.J Magn Reson Imaging 2010;32:242-248.4.Saritas EU, Cunningham CH, Lee JH, et al. Magnetic Resonance in Medicine 2008;60:468–473. 5.Kim SE, Jeong EK, Kholmovsiki EG, et al. Proc. Intl. Soc. Mag. Reson. Med. 14 (2006).