

High Resolution Diffusion Weighted Imaging of Pancreatic adenocarcinoma using 2D Reduced Field of View Single-Shot Echo-planar Imaging at 3.0 Tesla

Yan jun Li¹, Chao Ma¹, He Wang², Shi yue Chen¹, and Jian ping Lu¹

¹Department of Radiology, Changhai Hospital, The Second Military Medical University, Shanghai, China, ²MR Research China, GE Healthcare, Shanghai, China

INTRODUCTION:

Pancreatic cancer accounts for about 3% of all cancer cases, with a 5-year survival rate of less than 5% [1]. Diffusion-weighted magnetic resonance imaging (DW-MRI) is thus far the only noninvasive method to investigate the microscopic mobility of water molecules in the human body. Some studies indicated that DWI and measured apparent diffusion coefficient (ADC) values are promising in early detection of pancreatic diseases [2,3]. The most frequently used technique for DWI, especially for the pancreas, remains single-shot echo planar imaging (ss-EPI). To reduce the severe blurring of the images and the significant phase errors due to off-resonance, the k-space matrix is set to be smaller in the use of ss-EPI sequence than conventional MRI sequences (such as T₁WI, T₂WI). It would cause a low resolution in DWI and overestimation of the ADC value in the abdominal region with ss-EPI. The aim of our study is to demonstrate the feasibility of high resolution DWI of pancreas using 2D Reduced Field of View (RFOV) Single-Shot Echo-planar sequence [4] in the evaluation of pancreatic ductal adenocarcinoma and to define ADC values for these tumors.

METHODS:

50 normal volunteers and 50 patients with histopathologically proven pancreatic ductal adenocarcinoma by surgery were included in the study. High resolution DWI of pancreas was obtained by an 8 channel body-phased array coil using a multi section 2D Reduced Field of View Single-Shot Echo-planar sequence on the axial plane (FOV 16×8 cm², matrix 128×64, TR 5000ms, TE 56.5ms, b-value 600 s/mm²). In addition, the routine abdominal imaging protocol for upper abdomen was applied in the patient group and control group. We measured the ADC value within the normal pancreas in control group and pancreatic ductal adenocarcinoma group. Mann-Whitney U-test has been used to compare ADC values between tumoral tissues and normal pancreatic tissues of the volunteers.

RESULTS:

Higher resolution (1.25 x 1.25 mm² for axial images) diffusion weighted images of pancreas were successfully acquired and it showed much more clear tumor borders in RFOV DWI when compared to full FOV DWI. The mean and standard deviations of the ADC values (×10⁻³ mm²/s) were as follows: pancreatic ductal adenocarcinoma (n = 50), 1.53±0.26 (1.02 – 2.23), and normal pancreas in control group (n = 50), 1.99±0.25 (1.60 – 2.73). ADC values of the pancreatic ductal adenocarcinoma were significantly lower compared with those of normal pancreas (p = 0.000 < 0.05).

CONCLUSIONS:

RFOV DWI shows advantages in higher resolution (1.25 × 1.25 mm²) and blurring reduction compared to full FOV DWI (3.0 × 3.0 mm²) of the pancreas. It makes a statistically significant difference in the ADC measurements of the pancreatic ductal adenocarcinoma when compared to the control group. This approach is promising to benefit imaging applications such as early diagnosis of pancreatic cancers and image guided therapy.

REFERENCES:

- [1] Siegel R, Naishadham D, Jemal A. Cancer Statistics, 2012. *CA CANCER J CLIN* 2012;62:10–29.
- [2] Kartalis N, Lindholm TL, Aspelin P, et al. *Eur Radiol.* 2009;19:1981-1990.
- [3] Miriam K, Andreas L, Katharina G, et al. *Invest Radiol.* 2011;46:57-63.
- [4] Yuan J, Zhao TC, Tang Y, Panych LP. *J Magn Reson Imaging* 2010;32:242-248.

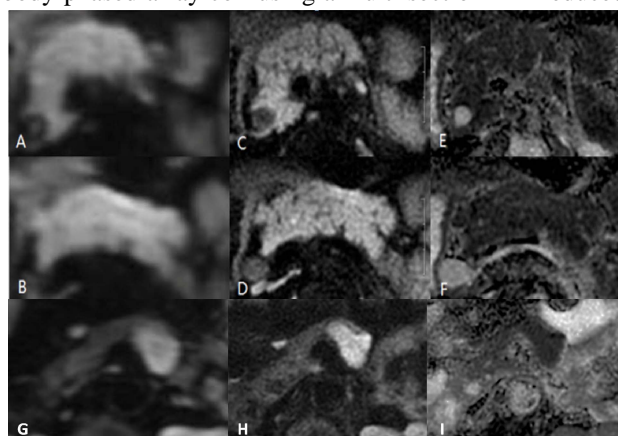


Figure 1. Full FOV DWI (b = 600 s/mm²) of a healthy pancreas (A,B) and RFOV EPI (C,D) with b = 600 s/mm², ADC map was calculated with RFOV DWI (E,F); Full FOV DWI of pancreatic ductal adenocarcinoma (G) and RFOV DWI (H), ADC map was calculated with RFOV DWI of b = 600 s/mm² (I).