The Reproducibility of Apparent Diffusion Coefficient Measurement in liver of healthy volunteers at 3.0T and 1.5T Diffusion Weighted Imaging

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Introduction

In recent years, the use of DWI has expanded beyond intracranial applications to abdominal applications (1) , and ADC measurements have been used as a quantitative tools for characterizing lesions, predicting and monitoring tumor response to treatment (2-5). Although some studies have showed good reproducibility of ADC of abdominal organ at different terms or in different volunteers (6-7), there is still little know about the variability of ADC measurements at DWI of the liver with different field strength. Therefore, the aim of our study is to evaluate the reproducibility of ADC measurement in liver of healthy volunteers at 1.5T and 3.0T DWI.

Methods

30 healthy volunteers formed a clinical study population (15 men, 15 women; mean age 26 and ranged 22-40). Informed consent was obtained from all volunteers. DWI was performed at both 1.5T (Signa TwinSpeed HD, GE System) and 3.0T (Achieva, PHILIPS System) MR scanner at the same day and 8-element phased array coils were used to receive MR signal. Applied DWI sequence was respiratory triggered single shot SE-EPI: section thickness 6 mm with a gap of 1.5 mm, diffusion gradient was applied in three mutually perpendicular directions(S/I, R/L, A/P) and b values were 0 and 600 s/mm^2, TR=2 respiratory cycles, TE=60.8ms at 1.5T and 48ms at 3.0T, parallel acceleration factor of two and four acquired signal. 4 nonoverlapping regions of interest (ROIs) with a standardized size of larger than 50 pixels were placed in homogeneous artifactfree areas of VI segment of liver, with large blood vessels excluded (Figure1-2), and the mean ADC value of the 4 ROIs represented the ADC of the liver in a single individual. Paired Sample T test was applied to statistical analyses.

Results

The mean ADC value of liver was 1.57 $\times 10^{-3}$mm^2/s $\pm$0.10 at 1.5T, while 1.35 $\times 10^{-3}$mm^2/s $\pm$0.12 at 3.0T (t=10.12, P<0.001). And the mean ADC value measured at 1.5T was always larger than that at 3.0T in almost all case, except in one case (The ADC value of the liver at 1.5T was mildly lower than that at 3.0T).

Discussion and Conclusion

Oncologic applications of DWI have been of particular interest. DWI has been used as a qualitative screening sequence of body tumor. In addition, ADC measurements have been used as quantitative tools for predicting and monitoring tumor response to treatment because the free diffusion of water increases with the breakdown of tumor cells (2-6). If ADCs are to be clinically useful, particularly for predicting and/or monitoring therapeutic effects, they must be robust and reliable. Although some studies have showed good reproducibility of ADC of abdominal organ at different term or in different volunteers (6-7), there is still little know about the variability of ADC measurements at DWI of the liver with different field strength.

In our study, the mean ADC value of liver was higher than that at 3.0T (P<0.001). Although the DWI obtained at two MR scanners had same condition except TE, scanner, and their magnetic field strength, it is still unknown that the significant difference of ADCs at assessment of the 1.5T and 3.0T reproducibility of ADC measurements is due to which one of the three factors above or all of them. It needs future study to research and prove. However our results at least indicate that ADCs are not robust and reliable enough to be used as quantitative tools when different MR scanners or different fields are used in the same patient.

Reference

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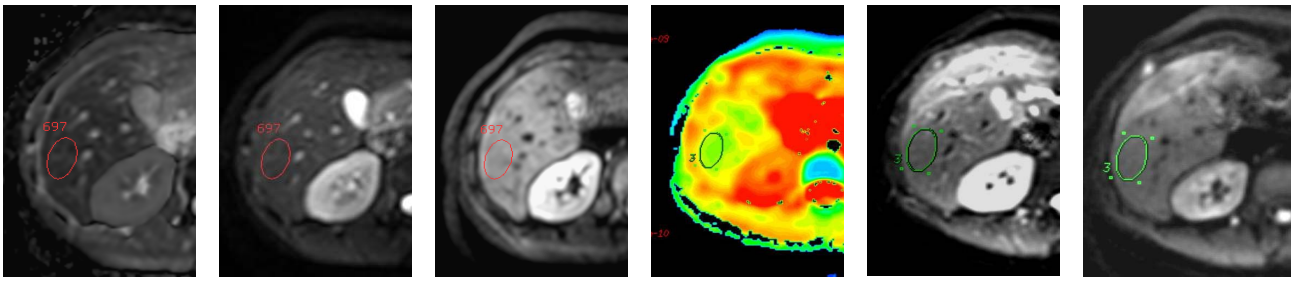

a. **b.** **c.** **d** **e** **f**

Figure: Axial ADC map(a) at 3.0T MR scanner of the liver, acquired with b values of 0 (b) and 600 s/mm^2(c). One ROI was placed in VI segment(artifactfree area, blood vessel excluded, the other 3 ROIs were placed in other slices). Axial ADC map(d) at 1.5T MR scanner of the liver of the same volunteer, acquired with b values of 0(e) and 600 s/mm^2(f).