

Comparison of Three Different Diffusion Weighted Imaging Acquisitions of The Upper Abdomen Between 1.5 T and 3 T

Zhuo Shi¹, Xinming Zhao¹, Han Ouyang¹, and Lizhi Xie²

¹Department Of Imaging Diagnosis, Cancer Hospital, Chinese Academy of Medical Sciences & Peking Union, Beijing, Beijing, China, ²GE Healthcare China, Beijing, China

Purpose This study performed comparisons of the diffusion-weighted MR imaging (DWI) of upper abdomen between 1.5T and 3T in breath-hold, respiratory-triggered and free-breathing techniques.

Introduction

Diffusion weighted magnetic resonance imaging (DWI) have been widely applied in the assessment of abdominal viscera diseases; which provide useful information [1-2]. At present, numerous upper abdominal MRI examinations were performed on 3T magnetic resonance machine. , A number of hospitals also have used 1.5T. The focus of this study, is to perform quantitative analysis including signal-to-noise ratio (SNR), apparent diffusion coefficient (ADC), qualitative artifacts severity, subjective image quality of the breath-hold (BH), respiratory-triggered (RT) and free-breathing (FB) DWI between the 1.5T and 3T techniques. To determine the best DWI acquisitions for upper abdomen, and demonstrate it as a reference for the clinical work in the future.

Method and Experiment

Twenty one volunteers were examined in GE Signa HDx 1.5T and 3.0T MR with the body surface and phased-array coil for regular MR and breath-hold, respiratory-triggered and free-breathing DWI examinations. The b value of each DWI was 100 and 800 s/mm², respectively. As well as, the acceleration factor of the parallel imaging technique (PI) is 2. Two doctors recorded and evaluated the image artifacts, subjective image quality scores, signal-to-noise ratio, and apparent diffusion coefficient (ADC) value by using the GE AW44 Workstation. In this study, the SPSS17.0 statistical software (LEAD Technologies, New York, NY) has been used for the data analysis, P value less than 0.05 was considered statistically significant. The three kinds DWI require multiple comparisons, on the basis of Bonferroni correction, $P < 0.05/3 = 0.0167$ was considered statistically significant.

Results

Respiratory triggered DWI's image quality in 3T is better than 1.5T ($P < 0.05$), free-breathing DWI's artifact score and image quality in 1.5T are better than 3 T ($P < 0.05$); Free-breathing DWI's signal-to-noise ratio was higher than respiratory triggered and breath-hold DWI. The gallbladder, right kidney, spleen and pancreas' SNR of 3T were higher than 1.5 T, but the liver was opposite ($P < 0.05$); The ADC values of the liver, gallbladder, kidney and pancreas had recorded no statistically difference between 1.5T and 3T ($P > 0.05$), the spleen's ADC value is the lowest one among these organs; The repeatability of most signal intensity's measurement between two observers was well, when the value of the b=100 and 800.

Conclusion. 3T respiratory triggered technology can access comparatively better DWI quality; and free-breathing DWI has the highest SNR; the ADC values of the normal liver parenchyma, gallbladder, kidney, spleen and pancreas have no difference between 1.5T and 3T.

Reference

- [1] Doshi AM, Campbell N, Hajdu CH, et al. Differentiation of malignant omental caking from benign omental thickening using MRI [J]. Abdom Imaging, 2014, Oct 14.
- [2] Miller FH, Hammond N, Siddiqi AJ, et al. Utility of diffusion-weighted MRI in distinguishing benign and malignant hepatic lesions [J]. J Magn Reson Imaging, 2010; 32(1): 138–147

Table 1 comparison of the image quality and artifacts of three DWI acquisitions between different field strength

	b value	RT	BH	P	RT	FB	P	BH	FB	P
image quality score										
1.5T	b=100	3.5±0.5	2.7±0.6	0.003	3.5±0.5	3.6±0.5	0.7	2.7±0.6	3.6±0.5	0.001
	b=800	2.5±0.5	2.4±0.7	0.9	2.5±0.5	2.7±0.4	0.4	2.4±0.7	2.7±0.4	0.1
3T	b=100	3.9±0.3	2.5±0.7	<0.0001	3.9±0.3	2.3±0.7	<0.0001	2.5±0.7	2.3±0.7	0.3
	b=800	3.1±0.3	2.4±0.5	0.006	3.1±0.3	2±0.7	0.0004	2.4±0.5	2±0.7	0.06
average pseudo points										
1.5T	b=100	1.2±0.3	1.9±0.4	<0.0001	1.2±0.3	1.6±0.3	0.03	1.9±0.4	1.6±0.3	0.09
	b=800	1.7±0.4	2.5±0.5	0.0003	1.7±0.4	1.9±0.5	0.4	2.5±0.5	1.9±0.5	0.01
3T	b=100	1.5±0.5	2.5±0.4	<0.0001	1.5±0.5	2.7±0.4	<0.0001	2.5±0.4	2.7±0.4	0.4
	b=800	1.6±0.5	2.7±0.5	0.0001	1.6±0.5	2.9±0.5	0.0001	2.7±0.5	2.9±0.5	0.5

Table 2 The ADC value of two different fields

organ	1.5T	3.0T	D score	P
liver	1.16±0.2	1.13±0.2	0.03±0.024	0.3
gall bladder	2.6±0.4	2.6±0.3	0.001±0.082	0.9
kidney	1.8±0.1	1.8±0.1	0.013±0.021	0.7
Spleen	0.7±0.05	0.68±0.08	0.017±0.014	0.2
pancreas	1.07±0.1	1.08±0.1	-0.011±0.021	0.6

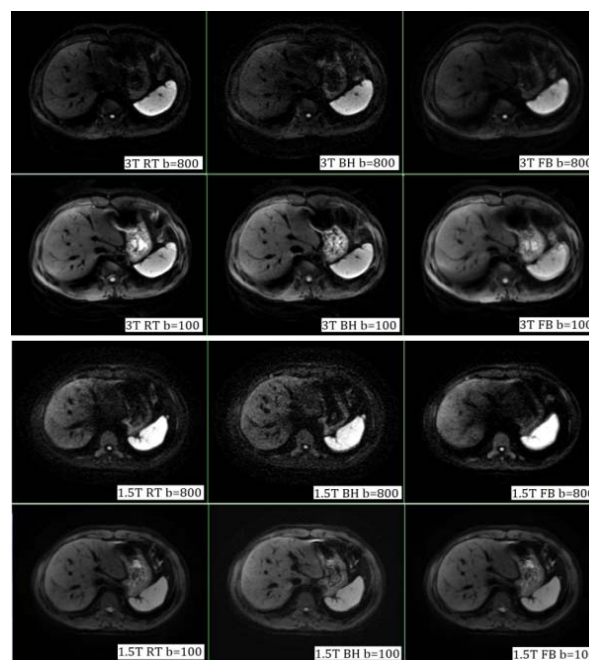


Fig1. volunteer's scan findings of the same level from 3 T 1.5 T