Clinical Application of Diffusion-Weighted Imaging with ASSET Technique for Breast Lesions

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Purpose To explore the tehnical feasibility of DWI with ASSET (array spatial sensitivity encoding technique) for patients with breast diseases, and evaluate the diagnosis value of ASSET-DWI in distinguishing benign and malignant breast lesions.

Materials and Methods Fifty-six patients with histologically proven malignant (39 cases with 40 lesions) and benign (17 cases with 20 lesions) lesions in breast and 20 healthy volunteers underwent bilateral breast axial SS-EPI with ASSET technique (b value being 0, 600s/mm^2 and 0, 1000s/mm^2), SE T1WI, FSE T2WI by 4-channal phased-array breast coil at 1.5T (GE). Among them, Sixteen patients with breast lesion and 7 healthy volunteers underwent conventional SS-EPI, the imaging quality and the ADC values of normal breast tissues and lesions on ASSET-DWI were compared with that of conventional DWI. The diagnositic value of ASSET-DWI in distinguishing benign and malignant lesions were analyzed.

Results Among the 16 patients and 7 healthy volunteers, all breast tissues and 3 lesions showed distortion on conventional DWI, while the distortion were diminished by ASSET-DWI with 50% shorter acquisition time (Fig 1). There is no difference of ADC values between ASSET-DWI and conventional DWI (P>0.05). There is statistically difference among the mean ADC value of the malignant lesions, the benign ones and nomal breast tissues measured on ASSET-DWI with b=600s/mm^2 or b=1000s/mm^2 (P<0.05), respectively. The mean ADC and range of 95% confidence of that were showed in table 1. The sensitivity of ADC value for malignant lesions with a threshold of less than 1.44×10^{-3} mm^2/s (b=600 s/mm^2) or 1.18×10^{-3} mm^2/s (b=1000s/mm^2) was 80% (32/40) and 77.5% (31/40), respectively. The specificity of both groups was 95% (19/20) (Fig 2-4).

Table 1 Mean ADC value and range of 95% confidence of benign lesions, malignant ones and normal breast with different b value

		N	Mean ADC value (×10^{-3}mm^2/s)	Range of 95% confidence (×10^{-3}mm^2/s)
b=600s/mm^2	Malignant lesions	40	1.33±0.36*$^{\#}$	1.21~1.44
	Benign lesions	20	1.82±0.31$^{\blacktriangle}$	1.68~1.97
	Normal breast	20	2.05±0.33	1.90~2.21
b=1000s/mm^2	Malignant lesions	40	1.08±0.32*$^{\#}$	0.97~1.18
	Benign lesions	20	1.61±0.33$^{\blacktriangle}$	1.45~1.76
	Normal breast	20	1.85±0.33	1.70~2.0

*P<0.05 indicating comparision between the malignant and benign lesions, $^{\#}$ P<0.05 between the malignant and normal breast and $^{\blacktriangle}$ P<0.05(0.021; 0.032) between the benign lesions and normal breast.

Conclusions ASSET-DWI can be used for breast with decrease of distortion and acquisition time. Either b value being 600s/mm^2 or 1000s/mm^2 , ADC value of ASSET-DWI all can be used to distinguish majority of malignant lesions from benign ones. The diagnostic threshold of ADC value should be matched with the b value used in ASSET-DWI simultaneouly.

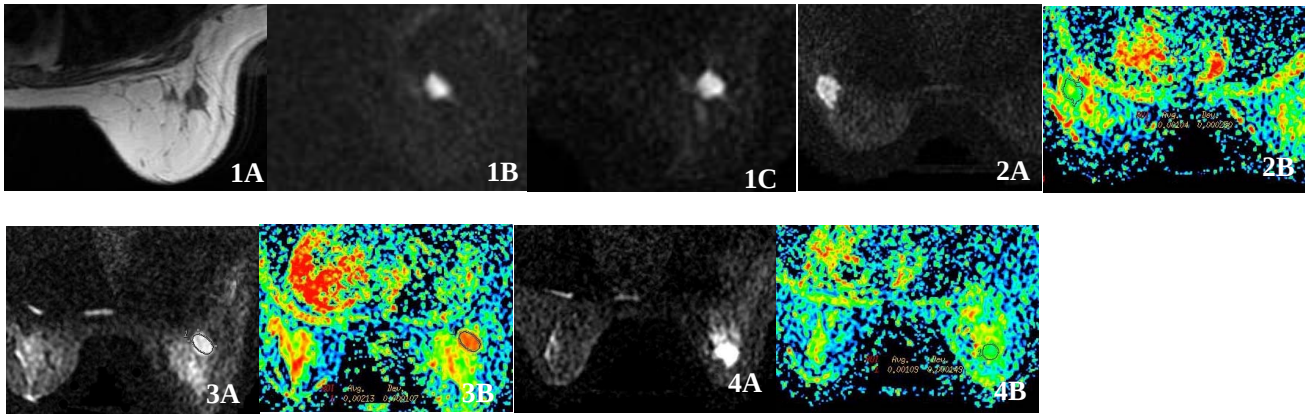

Fig1. 1A is axial T1WI, a mass in left breast. 1B is conventional DWI (SS-EPI), 1C is ASSET-DWI. The lesion shows distortion on conventional DWI compared with it on T1WI. The distortion is decreased on ASSET-DWI.

Fig2. A 52 years old female with invasive ductal carcinoma in right breast. 2A is ASSET-DWI, the lesion in right breast shows high signal on DWI. 2B is the ADC colour map, the ADC value of the lesion is lower (1.04x10^{-3}mm^2/s) (b=1000s/mm^2).

Fig3. A 41 years old female with fibroadenoma in left breast. 3A is ASSET-DWI, the lesion in left breast shows high signal on DWI. 3B is ADC colour map, ADC value of the lesion is higher (2.13×10^{-3}mm^2/s) (b=1000 s/mm^2).

Fig4. A 57 years old female with intraductal papillomatosis in left breast. 4A is ASSET-DWI, the lesion in left breast shows high signal on DWI.4B is ADC map, the ADC value of the lesion is lower (1.09×10^{-3}mm^2/s) (b= 1000s/mm^2).