Non-Breath-Hold Diffusion Weighted Imaging for the Body: Signal Characteristics, Artifacts and Lesion Conspicuity

M. Takahashi[1], Y. Takehara[2], K. Ichijo[1], N. Tooyama[1], H. Sakahara[2], A. Nozaki[3]

[1]Radiology, Seirei Mikatahara General Hospital, Hamamatsu, Shizuoka, Japan, [2]Radiology, Hamamatsu University of Medicine, Hamamatsu, Shizuoka, Japan, [3]General Electric Yokogawa Medical System,Ltd, Hino, Tokyo, Japan

BACKGROUND

Recently, there is a trend in the style of data acquisition of diffusion weighted imaging (DWI), which is multiple signal averaging under free breathing instead of breath-holding (1). The method provides improved signal to noise ratio of the DWI as compared to single signal averaging, and the artifact is reasonably controlled in spite of patients' respiratory motion.

PURPOSE

The purpose of this study is to assess signal characteristics, artifacts and lesion conspicuity in non-breath-hold body diffusion weighted imaging.

METHOD AND MATERIALS

111 consecutive patients were examined using a 1.5T MRI scanner (Signa CV/i Ver.9.1, GE Medical Systems). Fifteen to 84 gapless axial sections with 4-7 mm thickness were obtained using a diffusion weighted SE-EPI. The parameters used were as follows; NEX = 6, FOV = 40, matrix = 128x128. Three pairs of MPGs were employed in all directions with b-value of 1000 s mm-2.

The CNRs of the abdominal organs and lymph nodes as compared to the background fat signal w ere then calculated. Concerning the lesions within the organs, CNRs of the lesions as compared to the signal of the surrounding tissue were calculated.

RESULTS

In all cases, susceptibility artifacts, motion artifacts and N/2 artifacts appeared; however, severe artifacts that made the images non-diagnostic occurred only in three cases (2.7%).

Concerning the CNRs of the normal abdominal organs, the spleen, the adrenal gland, the uteri ne endometrium, the prostate and the kidneys were frequently higher than other organs. All malignant and inflammatory lymphadenopathy showed extremely high CNR; however physiological lymphnodes frequently showed problematic high CNR. (Table 1.) The signal of the lesions was conspicuously higher than surrounding tissue in 88% of the malignant neoplasm, in 58% of the benign neoplasm and in 100% of the inflammatory processes. (Table 2.) Defining a simple visual diagnostic criterion that "higher signal intensity as compared to the surrounding tissue is malignant", the s ensitivity, specificity and accuracy of the body DWI were 82%, 58% and 66% respectively. Almost all malignant lesions had high signal intensity on body DWI, but hepatomas and prostatic cancers were not visualized because of poor contrast created by relatively high signal of t he surrounding normal tissue, which resulted in conceivable high signal only in 60%(3/5) and in 37.5%(3/8) respectively.(Table 3.)

CONCLUSION

Body diffusion imaging may be a useful adjunct to MR examination in terms of highlighting the lesions; however, the discrimination between benign and malignant may be difficult.

REFERENCE

1: Takahara T, et al.Radiat Med. 2004;22(4):275-82.

Table 1. CNRs of malignant, benign and inflammation lesions and of physiological and metastatic lymph nodes

	Malignant lesion	benign lesion	inflammation	Physiological	Metastatic
Average	17.58	4.63	17.50	12.49	22.55
SD	10.28	15.54	14.66	6.25	16.71

Table 2. Positive findings for lesions

	Malignant	(ratio)	benign	(ratio)	inflammation	(ratio)
Positive	53	0.883	37	0.544	22	1
Negative	7	0.117	31	0.456	0	0
Total	60	1	68	1	22	1

Table 3. Diagnosis ability of malignant lesion for individuals

	Malignant	not malignant	Total
Positive	32	31	63
Negative	7	41	48
Total	39	72	111

Sentitivity＝0.821, spicificity=0.581, accuracy = 0.658

PPV = 0.508, NPV = 0.658