MR imaging of the neck at 3 Tesla using the periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) (BLADE) sequence compared with T2-weighted fast spin-echo sequence

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INTRODUCTION:

Although T2-weighted fast spin-echo (FSE) magnetic resonance (MR) sequences are sensitive for the detection of some types of pathologic conditions, they have the disadvantage of relatively long acquisition times (1). This can lead to degradation of images in the neck as a result of swallowing, tongue movement, and upper chest wall movement. The Periodically Rotated Overlapping ParallEL Lines with Enhanced Reconstruction (PROPELLER) (BLADE) MR technique can reduce artifacts induced by in plane rotation and translational head motion using an alternative way of sampling k-space (2-4). Unlike rectilinear k-space sampling, this method acquires multiple echo trains of a turbo spin echo (TSE) in a rotating partially overlapping fashion, so-called blades. The BLADE technique has the advantage of central k-space oversampling, so that image artifacts are greatly reduced in the brain and the upper abdomen (2-4). On the other hand, it is not yet evaluated that the BLADE sequence at 3 T can reduce motion artifacts in the neck region. The aim of this study was to compare T2-weighted BLADE sequence with T2-weighted FSE sequence in the neck, with an evaluation of the presence of motion artifacts, tissue contrasts, and lesion detectability.

MATERIALS AND METHODS:

Forty-six patients referred for MR imaging of the neck were included in a comparison of T2-weighted BLADE (T2W-BLADE) sequence and T2-weighted fast spin-echo (T2W-FSE) sequence. All examinations were performed with a 3.0-T imaging unit (MAGNETOM Trio, A Tim 3.0T; Siemens Medical System, Erlagen, Germany) with a head-matrix coil and a neck-matrix coil using 16 coil elements using the same parameters (TR/TEeff/FA, 4500/87/120; slice thickness 5 mm; FOV 220 mm; matrix 320 × 320). Two observers evaluated unlabelled images for motion artifacts (ghosting artifacts, pulsation artifacts, and streak artifacts), susceptibility artifacts, the preferred image quality, and lesion detectability. Region of interest-based quantitative measurements were performed to assess tissue contrasts. Before the test, we interpreted free of artifacts and mild artifacts as no clinically significant artifact. If moderate or severe motion artifacts were seen, the data set was assigned for clinically significant artifacts. The frequency of occurrence of the different assessed artifacts and the lesion detectability was tested using McNemar's test. Tissue contrasts were compared using the Wilcoxon paired test and the Mann-Whitney U test. Reader agreement was assessed using kappa test.

RESULTS:

We diagnosed 28 solid tumors in 28 patients and 4 cystic lesions in 4 patients. Table 1 shows image degradation due to artifacts. T2W-BLADE showed less motion artifacts than T2W-FSE (Observer 1: $P < 0.01$; Observer 2: $P < 0.05$; $\kappa = 0.71$ in T2W BLADE; $\kappa = 0.68$ in T2W-FSE). There were not statistically significant differences between T2W-BLADE and T2W-FSE in terms of susceptibility artifacts ($\kappa = 0.88$ in T2W-BLADE; $\kappa = 0.88$ in T2W-FSE). Figure 1 shows the sequences that the readers preferred. Both observers rated T2W-BLADE images as better than or equal to T2W-FSE images in 43 cases (93.5%; kappa = 0.64). There were not statistically significant differences between T2W-BLADE and T2W-FSE in terms of tissue contrasts between muscle and solid tumors and tissue contrasts between muscle and cystic lesions. The mean tissue contrasts between muscle and cystic lesions was significantly higher than the mean tissue contrasts between muscle and solid tumors in both T2W-BLADE and T2W-FSE (the Mann-Whitney U test; $P < 0.01$). Both observers detected 28 solid tumors and 4 cystic lesions and judged the tumors and lesions on T2W-BLADE as better than or equal to T2W-FSE (Figure 2).

CONCLUSION:

The advantage of T2W-BLADE of the neck is to reduce ghosting and pulsation artifacts. The disadvantage of T2W-BLADE of the neck is to degrade the image quality occasionally due to streak artifacts, which generally are weaker than ghosting and pulsation artifacts in T2W-FSE. T2W-BLADE can provide tissue contrasts and lesion detectability equivalent to T2W-FSE.

Table 1 Image degradation for T2W-FSE and T2W-BLADE due to artifacts

Reader 1	T2W-FSE				T2W-BLADE			
Score	0	1	2	3	0	1	2	3
Ghosting	2	15	23	6	46	0	0	0
Pulsation	4	22	16	4	46	0	0	0
Streak	46	0	0	0	16	18	10	2
Susceptibility	42	3	1	0	42	3	1	0
Reader 2	T2W-FSE				T2W-BLADE			
Score	0	1	2	3	0	1	2	3
Ghosting	2	21	13	10	46	0	0	0
Pulsation	9	19	13	5	46	0	0	0
Streak	46	0	0	0	17	11	16	2
Susceptibility	40	5	1	0	40	5	1	0

0 = free of artifacts; 1 = mild artifacts; 2 = moderate artifacts; 3 = severe artifacts.

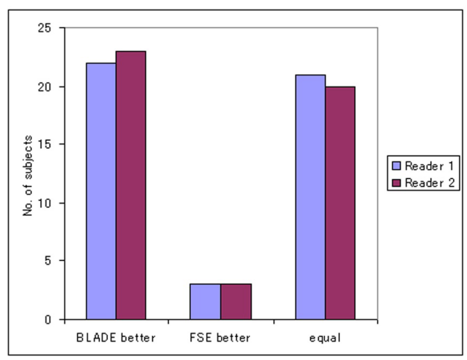

Figure 1. Bar graph reveals the sequences that the observers preferred

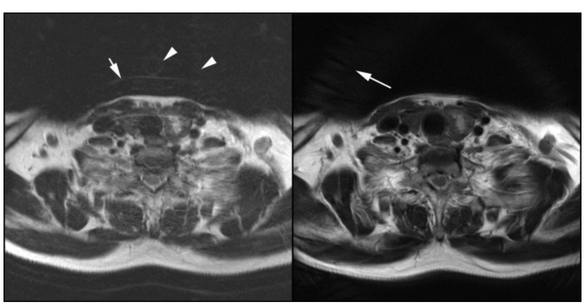

Figure 1 A 73-year-old man with thyroid adenoma.
(a) Severe ghosting artifacts (arrows) from respiration motion and pulsation artifacts (arrowheads) from the vessels and the CSF flow substantially degrade T2-weighted FSE image.
(b) T2-weighted BLADE image shows no ghosting and pulsation artifacts. The pathology clearly depicted, although there are a few streak artifacts (arrow) in the background surrounding the neck.

References
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