T2-weighted MR imaging in the female pelvis with PROPELLER (BLADE) data acquisition; comparison with conventional T2-weighted MR images

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Introduction:

Although the artifacts from respiratory motion are limited in the female pelvic region, motion artifacts from the abdominal wall and intestine degrade MR images. Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction (PROPELLER) is one of non-Cartesian data acquisition technique, and has been applied to the motion correction in brain imaging. The purpose of this study is to compare PROPELLER-T2WI with conventional T2WI to investigate the advantages and limitations of this technique.

Materials and Methods:

Our study population consisted of 35 subjects, including 9 healthy volunteers (age; 30±5) and 26 patients (age; 51±16) who underwent pelvic MRI for gynecologic diseases (uterine endometrial cancer 8, uterine cervical cancer 7, leiomyoma 4, ovarian tumor 4, pelvic floor decent 1, partial mole 1, placenta previa 1). MRI was performed at 1.5T scanner (Symphony; Siemens) utilizing a multi-channel phased array coil. MR protocol included a set of sagittal conventional T2WI (TR/TE=3730-6530/105-120) and PROPELLER-T2WI (TR/TE=6760-9500/113), with identical other parameters, including FOV of 260mm, thickness of 5mm, interslice gap of 0.9-1.5mm and matrix of 320. MRI was obtained either with (n=20) or without (n=15) intramuscular administration of anticholinergic agent (Buscopan). All MR images were independently evaluated by two radiologists using a 5-point scale, regarding the overall image quality and the sharpness of the configuration of the intestine, uterus, bladder and tumor, if present. The presence and type of artifacts in each sequence were also described. The results of MR image evaluation were compared in each subject.

Results:

The results of the evaluation of MR images are summarized on Table 1. PROPELLER-T2WI provided better overall image quality and lacked ghosting artifacts, which were always present in conventional T2WI. The delineation of the pelvic organs and tumors was superior to conventional T2WI, except for the bladder. In one patient with cervical carcinoma, PROPELLER-T2WI could successfully depicted tumor that was hardly recognizable on conventional T2WI (Fig. 1). However, PROPELLER-T2WI were associated with some minor but unique artifacts, including fine linear artifacts in the intestine (n=35) and bladder roof (n=12), faint sunburst like radiating lines from the body in all, wrap around artifacts (n=14), sharp lines at the corner of FOV (n=20). PROPELLER-T2WI in one of three pregnant women was severely degraded by artifacts from fetal motion.

Conclusion:

Compared with conventional T2WI, PROPELLER-T2WI can provide better image quality and clearer delineation of the organs in the female pelvis by eliminating the ghosting artifacts. However, this technique has minor but a variety of unique artifacts.

TABLE 1

	PROPELLER	Conventional	P value*
Overall (n=35)	4.1±0.7	3.0±0.8	<0.001
Uterus (n=35)	4.1±0.7	3.2±0.9	<0.001
Ovary (n=16)	4.3±1.7	3.1±1.0	0.001
Intestine (n=35)	3.2±0.8	2.8±0.9	0.009
Bladder (n=35)	4.0±0.8	3.9±0.8	0.395
Tumor (n=22)	4.0±1.2	3.2±1.0	0.001

* Calculated by Wilcoxon's signed-rank test.

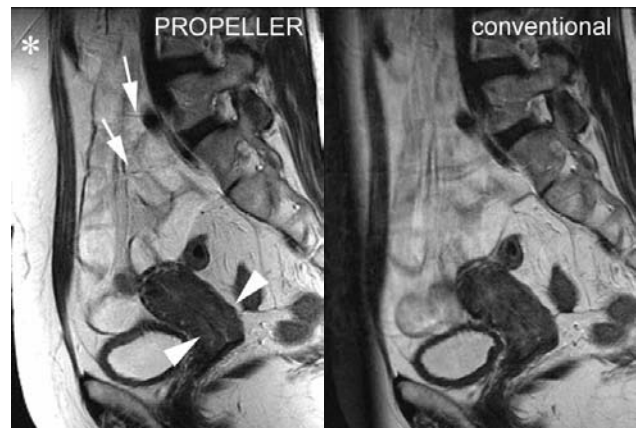$P < 0.05$ was considered statistically significant.

Figure 1. Sagittal PROPELLER-T2WI in a 58-year-old woman with cervical carcinoma provides better overall image quality and clearer delineation of the uterus and intestine by reducing ghosting and blurring caused by motion artifacts, and clearly demonstrates the tumor (arrowheads) that is hardly recognizable on conventional T2WI. Nonetheless, PROPELLER-T2WI has fine linear artifacts in the small intestine (arrows) and sharp lines at the corners of FOV (asterisk).