The utility of PROPELLER technique applying for T2-weighted thoracic MR imaging with PACE technique.

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Introduction:

Recent development of navigator mediated respiratory triggering, prospective acquisition and correction (PACE) technique, has remarkably improved respiratory motion artifacts in thoracic and upper abdominal MRI. However, MRI with PACE still has flow artifacts from heart and great vessels, and ghosting artifacts from respiratory motion. Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction (PROPELLER) is an emerging technique to correct the motion artifacts, and has been applied to brain MRI. Nonetheless, the utility of this technique for thoracic imaging has not been investigated. The purpose of this study is to investigate whether PROPELLER technique can further improves the image quality of thoracic MRI with PACE technique, highlighting the advantages and limitations of this technique

Materials and Methods:

Our study population consisted of 21 subjects, including 8 healthy volunteers (age;31±5) and 13 patients (age;61±15), who underwent thoracic MR imaging. The clinically suspected diseases in the 13 patients included 6 esophageal cancers, 3 lung tumors, 4 mediastinal tumors. MRI was performed at 1.5T scanner (Symphony; Siemens) utilizing a multi-channel phased array coil. MR protocols included a set of T2-weigthed fast spin-echo images with PACE with and without PROPELLER technique. Other parameters, including FOV of 300-350 mm, thickness of 3-5mm, interslice-gap of 3-5 mm, were identical in each set of scanning. Image section were coronal with RF pulse of craniocaudal direction in all subjects, except for patients with esophageal cancers those who were scanned with oblique sagittal section along the course of the esophagus. In healthy volunteers, sets of axial images with their hands up and down were additionally obtained. All MR images were independently evaluated by two radiologists using a 5-point scale, regarding the overall image quality, the delineation of the heart, great vessels, esophagus, liver and tumor if present. The presence and type of artifacts in each sequence were also described. Finally, the assessment of both T2WI was compared in each subject.

Results:

The results of MR image evaluation were summarized on Table 1. T2WI with PROPELLER provided better quality of overall image, the great vessels, esophagus and liver, and lacked ghosting artifacts from the diaphragm or thoracic wall and flow artifacts from the great vessels, which were always present in T2WI without PROPELLER (Fig.1). However, PROPELLER-T2WI were associated with some minor but specific artifacts, including fine linear artifacts in the heart, great vessels and intestine in all subjects, faint sunburst-like artifacts and sharp lines and decreased signal at the corner of FOV in all coronal images (Fig.1). All axial images scanned with the hands down were remarkably degraded by radiating wrap around, which disappeared in all axial images with hands up.

Conclusion:

PROPELLER technique improve the T2WI with PACE in the thorax with better image quality and clearer delineation of the mediastinal and upper abdominal organs, by eliminating both flow artifacts and ghosting artifacts. However, this technique has some specific artifacts. Axial images should be taken with the hands up.

Table 1

	With PROPELLER	Without PROPELLER	*P* value*
Overall	3.8±0.6	2.6±0.5	<0.001
Heart	2.5±0.6	2.2±0.5	0.58
Great Vessels	2.5±0.7	2.2±0.7	0.001
Esophagus	3.1±0.6	2.4±0.7	0.01
Liver	3.1±0.7	2.4±0.4	0.01
Tumor (n=12)	3.2±0.6	2.8±0.6	0.59

* Calculated by Wilcoxon's signed-rank test.

$P < 0.05$ was considered statistically significant.

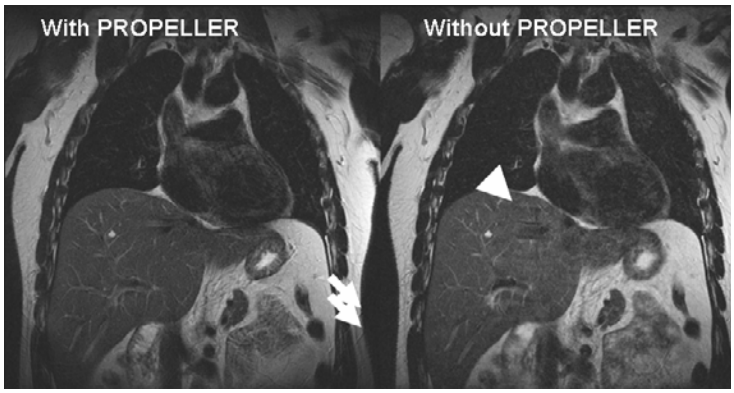

Figure 1. Coronal T2WI with PROPELLER in a 41-year-old male provides better overall image quality and clearer depiction of the liver and great vessels, by eliminating ghosting artifacts (arrowhead) and flow artifacts in T2WI without PROPELLER. However, T2WI with PROPELLER has fine linear artifacts in the heart, great vessels and intestine, sharp lines (arrows) and decreased signal at the corner of FOV.