

Poster presentation

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## Impact of sequence choice on flow measurement by phase contrast in the ascending aorta: breath hold and non breath hold

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### Introduction

Cardiac Magnetic Resonance (CMR) is well suited for cardiovascular flow assessment. CMR offers unlimited imaging planes, does not require a contrast agent, and is free of ionizing radiation. Additionally, phase contrast velocity mapping (PCVM) allows non invasive quantification of blood flow and velocity with good reproducibility.

Application of PCVM to the assessment of aortic flow is useful as part of a routine cardiac MRI functional assessment. PCVM can be performed as either a breath hold (BH) or non breath hold (NBH) acquisition. Some authors have suggested that NBH represents the preferred approach to phase contrast flow assessment. The impact of CMR sequence choice on PCVM of aortic flow in a clinical setting is not known.

### Purpose

To assess the impact of sequence selection, including BH and NBH approaches, in the clinical assessment of forward and regurgitant flow in the ascending aorta by PCVM.

### Methods

55 consecutive patients (45 male, 51 +/- 19 years) referred for clinical CMR of the thoracic aorta were included. Both BH and NBH (Table 1) sequences were performed at the sinotubular junction (ST) and mid ascending aorta. (MA). 10 additional patients were evaluated at MA, with NBH and BH sequences performed 2 times each to assess for within sequence variation. Finally, in 10 patients 8 gallon water phantoms were imaged using identical imaging parameters as the clinical protocol to evaluate potential offset errors associated with each sequence.

### Results

Differences were observed between the two sequences (Table 2). Slightly greater forward volumes were observed using the NBH technique. There was overlap in variation noted between sequences for forward volume measurement when compared to within sequence variation, however the regurgitant volumes did not show similar overlap. Smaller within sequence variation was noted with NBH. The phantom assessment revealed slightly smaller offset errors with use of NBH sequence.

### Conclusion

Differences exist between flow results obtained with BH and NBH sequences, and caution should be used when comparing results obtained using these two different approaches. Within sequence variability and phase offset values both showed a trend toward higher values with BH sequence, and represent areas of further inquiry to optimize accuracy of PCVM flow assessment.

**Table 1: Scanning parameters**

Parameter	BH	NBH
Echo time TR/TE (ms)	4.8/2.8	6.9/4
Flip angle (degrees)	12	30
Bandwidth	478	263
Matrix size	320 × 300	320 × 260
Pixel size (mm)	2.5 × 2.62 recon 1.25	1.7 × 1.4 recon 1.25
Frames/cycle	30	30
NSA	1	3
SENSE factor	2	1.5
Typical acquisition window (s)	16	150

**Table 2: Measured volumes (55 patients)**

Values/cardiac cycle	BH mean	NBH mean	Mean abs. difference, SD	Signed mean difference, SD	P
Forward volume, STJ	97.9 mL	102.1 mL	8.9 mL (8.0)	-4.2 mL (11.2)	.0004
Regurgitant volume, STJ	10.7 mL	12.5 mL	4.8 mL (9.2)	-1.8 mL (10.2)	.18
Regurgitant fraction, STJ	10.6%	10.6%	3.9% (4.7)	+0.4 (6.1)	.96
Forward volume, MA	92.0 mL	94.8 mL	6.3 mL (4.9)	-2.8 (7.5)	.01
Regurgitant volume, MA	8.6 mL	8.2 mL	2.0 mL (2.0)	+4 mL (2.9)	.12
Regurgitant fraction, MA	9.0%	8.0%	2.6% (3.3)	+ .9% (4.1)	.06

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