

Poster presentation

Regional aortic pulse wave velocity with 2-directional in-plane velocity-encoded MRI

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Introduction

The propagation speed of the systolic blood pressure wave determined from intravascular pressure measurements is the gold standard for Pulse Wave Velocity (PWV)-assessment. Velocity-encoded MRI provides a non-invasive alternative for PWV-assessment when using the transit-time method [1]. Conventional one-directional through-plane velocity-encoded MRI still shows high variation with the gold standard.

Purpose

To describe accuracy and reproducibility of regional PWV-assessment with high temporal 2-directional in-plane velocity-encoded MRI.

Methods

MRI was performed on 1.5 T Philips Achieva MRI (Philips Medical Systems, Best, The Netherlands). Regional PWV-assessment was performed by two-directional in-plane velocity-encoded MRI in a double-oblique stack of three consecutive slices, with total slab thickness of 3 cm covering the full aorta in the acquisition volume, velocity sensitivity 150 cm/s in AP and FH direction with approximately 10 ms temporal resolution. Flow velocity waveforms were determined at 200 sample points equidistantly along the centerline of the aorta; regional PWV is

determined from the transit-time between sample locations (Figure 1).

Conventional transit-time PWV-assessment was performed for the aortic arch (AA), distal aorta (DA) and total aorta by one-directional through-plane velocity-encoded MRI with $V_{enc} = 150$ cm/s, acquired during free-breathing perpendicular to the ascending and descending aorta at the level transecting the pulmonary trunk and consecutively at the abdominal aorta with $V_{enc} = 100$ cm/s (Figure 2).

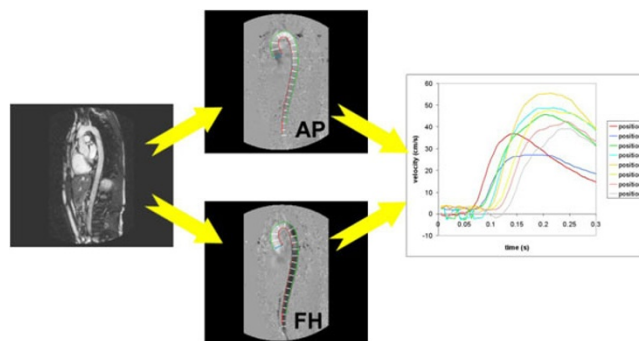


Figure 1

Table 1: Accuracy in PWV-assessment: MRI versus pressure. Conventional PWV-assessment shows larger differences, less correlation and more variation with pressure measurements than regional assessment, which is especially significant in the aortic arch.

	PWV _{total}		PWV _{AA}		PWV _{DA}	
	regional	conventional	regional	conventional	regional	conventional
bias	-0.4 ± 0.9 m/s	-0.5 ± 1.2 m/s	-0.3 ± 1.0 m/s	-1.9 ± 3.1 m/s	-0.6 ± 1.1 m/s	-0.4 ± 1.3 m/s
p-value	0.09	0.15	0.19	0.03*	0.06	0.28
Pearson R	0.60 (p = 0.01)	0.21 (p = 0.42)	0.96 (p < 0.001)	0.53 (p = 0.04)	0.47 (p = 0.06)	0.28 (p = 0.29)
Variation	14%	19%	14%	48%	18%	20%

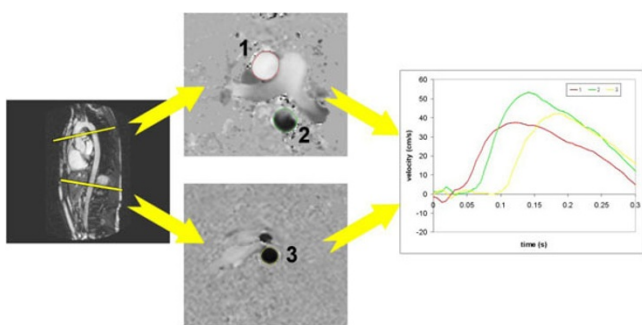


Figure 2

In sixteen patients scheduled for catheterization, PWV from MRI was compared with PWV from invasive pressure measurements during pullback with a 6F saline-filled catheter, from aortic valve to bifurcation at locations 5.8 cm apart. PWV was determined in AA, DA and total aorta. MRI was performed within two weeks after catheterization. In seventeen healthy volunteers, reproducibility of MRI-assessed PWV (conventional and regional) was tested by repeated MRI-acquisition after repositioning.

Informed consent of all participants and medical ethical approval was obtained.

Table 2: Reproducibility in PWV-assessment with MRI

	PWV _{total}		PWV _{AA}		PWV _{DA}	
	regional	conventional	regional	conventional	regional	conventional
MRI1-MRI2	0.2 ± 0.3 m/s	0.3 ± 0.6 m/s	0.6 ± 0.9 m/s	0.2 ± 1.0 m/s	0.5 ± 0.7 m/s	0.3 ± 0.8 m/s
p-value	0.02*	0.11	0.01*	0.48	0.02	0.23
Pearson R	0.97 (p < 0.001)	0.90 (p < 0.001)	0.89 (p < 0.001)	0.67 (p = 0.003)	0.86 (p < 0.001)	0.91 (p < 0.001)
Variation	7%	12%	15%	20%	15%	15%

I Results

See tables 1 and 2

Regional PWV-assessment shows less variation and better correlation with smaller differences for repeated acquisition.

Conclusion

Regional PWV-assessment with two-directional in-plane velocity-encoded MRI is more accurate than conventional one-directional through-plane velocity-encoded MRI when compared with gold standard, especially in the aortic arch. Repeated acquisition shows higher reproducibility for regional PWV-assessment.

Acknowledgements

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References

1. Grotenhuis HB, et al.: *J Magn Reson Imaging* 2009, **30(3)**:521-6.