PW4-6

Non-invasive three-dimensional pressure maps by flow-sensitive MRI: comparison of measurement accuracy compared to invasive catheterization in patients with aortic coarctation

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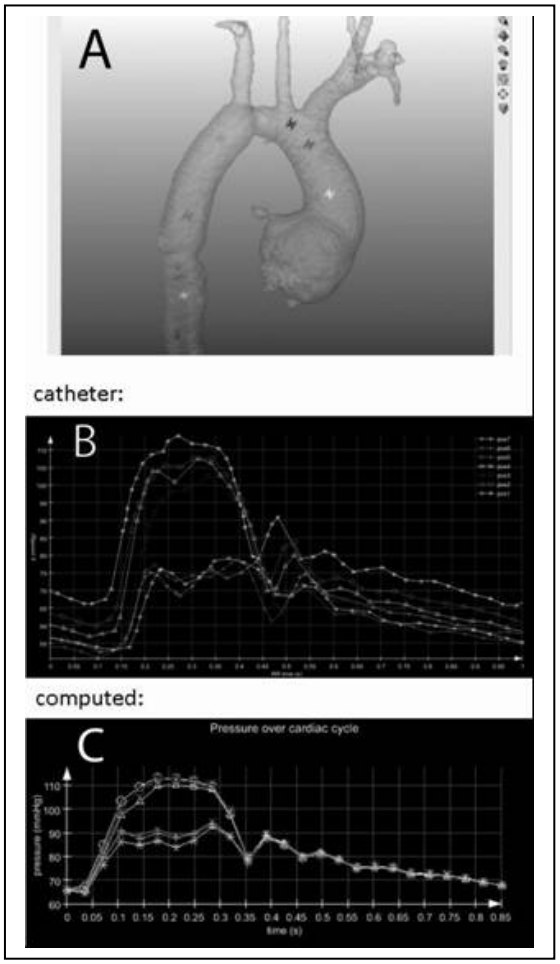
Background and Objectives:
State-of-the-art MRI provides superb anatomic and functional information but still lacks assessment of pressures. Data from four dimensional velocity-encoded cine magnetic resonance imaging (4D VEC MRI) can be computed into relative 3D pressure fields. In this study, we sought to investigate the accuracy of this method.

Methods:
Five patients (age range 14 to 40, mean 20 years, n=1 male, n=4 female) with re-coarctation of the aorta were referred to invasive diagnostic catheterisation. Pressures were acquired at several predefined locations along the thoracic aorta. Prior to catheterization, patients were studied by MRI including 4D VEC MRI of the aorta. Relative 3D pressure maps were computed based on the Navier-Stokes equation. Data was calibrated with one invasive pressure point obtained in the ascending aorta for computing of absolute pressures. Agreement of MRI and catheter derived peak systolic pressures were compared by Bland-Altman test.



Results: All MRI data were of good quality for analysis. Bland-Altman test showed good agreement of peak systolic pressures with a bias of 3,3 ± 3,3 mmHg. Maximal gradients were 20 mmHg (mean, range 10 to 25 mmHg) across the localized coarctation in four patients. One patient had a summation-gradient of 25 mmHg between ascending and descending aorta due to several mild stenoses along the thoracic aorta. The figure shows a representative case with a reconstructed MR angiography (A) and six locations for pressure measurements via catheter (B) and computed pressure curves (C).

Conclusion: The assessment of non-invasive pressure maps in aortic coarctation can be accurately obtained by non-invasive 4D MRI. This technique might evolve to an alternative to invasive diagnostic catheterisation for assessment of pressures.