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900 Boylston Street | Boston, Massachusetts 02215

Presentation Abstract

Session: 3-7-Engineering Advances in Pediatric Cardiology I

Presentation: **Pulmonary Insufficiency: Energy-based Assessment using 4D Phase Contrast MRI**

Location: 300

Presentation Time: Monday, Jul 07, 2014, 8:36 AM - 8:54 AM

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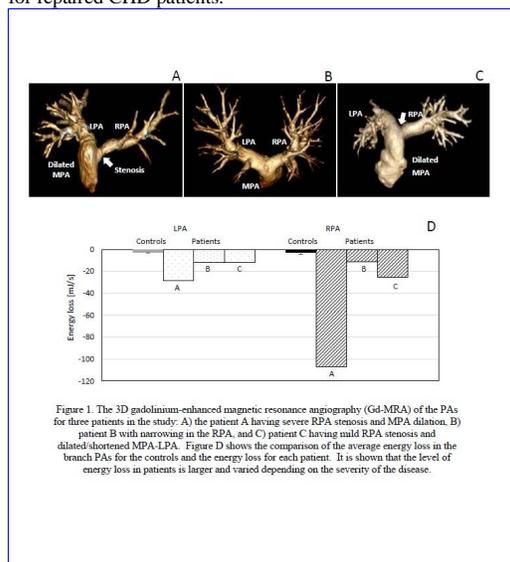
Abstract: Time resolved 3D phase contrast (PC) MRI with three-directional velocity encoding (flow-sensitive 4D) allows for complex blood flow analysis. This is particularly beneficial to both unrepaired and repaired congenital heart disease (CHD) patients in assessment of the abnormal hemodynamics in the heart. In this pilot study, we used 4D PC MRI data to compute energy loss in the branch pulmonary arteries (PAs) with the goal of characterizing right ventricular (RV)-PA pathophysiology, i.e. pulmonary insufficiency, in CHD patients.

4D PC MRI was performed for three patients and three control subjects. The patients had abnormal RV-PA physiology including pulmonary regurgitation, MPA dilation, and RPA stenosis (Fig. 1A to 1C). The control subjects had normal RV size and function and normal pulmonary valve anatomy and function. The velocity vector field in the PAs was obtained from 4D PC MRI and used to compute pressure drop that enabled us to evaluate energy loss in the branch PAs.

The overall level of energy loss in the branch PAs for the patients was generally larger than the controls (Fig. 1D). The energy loss in the LPA for the patients was significantly larger ($p = 0.05$) compared to that for the controls. However, the energy loss in the RPA was marginally significant between the two groups ($p < 0.2$). This is because the variability of the RPA energy loss among patients was high due to the different level of PA pathophysiology in each patient (Fig. 1D). It is expected that the p value of the energy loss between the two groups would decrease as the patient pool becomes larger.

The pressure drop in the branch PAs showed the similar trend.

Based on our observation, the energy loss may be an effective indicator for abnormal PA physiology since A) the level of energy loss in the branch PAs was significantly different between the two groups in the study and B) more importantly, it varied depending on the severity of disease of each patient. We believe that non-invasively computed energy loss in the branch PAs can help continuous and comprehensive assessment on RV-PA pathophysiology for repaired CHD patients.



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