

Testing two methods of quantitative flow measurement in the ascending aorta of patients with bicuspid and tricuspid aortic valves

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Introduction: Using 4D flow analysis was previously discussed, showing a great potential in visualizing and quantifying flow in cardiovascular diseases. In congenital heart diseases (CHD), 4D showed complex flow patterns; such as helical flow, in cases of aortic valve lesions. However intra-validation of flow measurements by 4D in CHD with complex flow pattern is lacking. The aim of this study is to test and validate 4D flow measurements using 2D phase contrast velocity encoding (PC-VENC) flow in the aorta in patients with bicuspid aortic valve with helical flow pattern.

Methods: Thirty-four participants underwent the 2D and 4D flow analysis in the ascending aorta. Eighteen of which were healthy volunteers (HV) and 16 were patients with bicuspid aortic valve disease (BAV). Velocity encoding was adjusted at 200 cm per second prospectively in both methods and in all patients. 2D Through Plane was planned perpendicular to the aortic segment from the localizer images. Field of view in the 4D was designed to include the aorta. Assessments of flow measurements from the 2D were done using the Argus flow tool by Siemens while the 4D flow measurements were done using the Fraunhofer Mevis flow tool. Region of Interest was determined at the level of the right pulmonary artery. Data from both methods were analyzed and compared. An interobserver agreement of the 4D data was performed using two blinded observers with the aforementioned 4D software to assess its reliability.

Results: The study showed good agreement between the 2D and 4D flow analysis in patients and normal subjects, as well as good agreements of the 4D interobserver assessment. Please refer to the Bland-Altman figures.

Conclusions: 4D flow analysis is a comprehensive method to assess flow measurements even in complex flow patterns in patients with CHD.

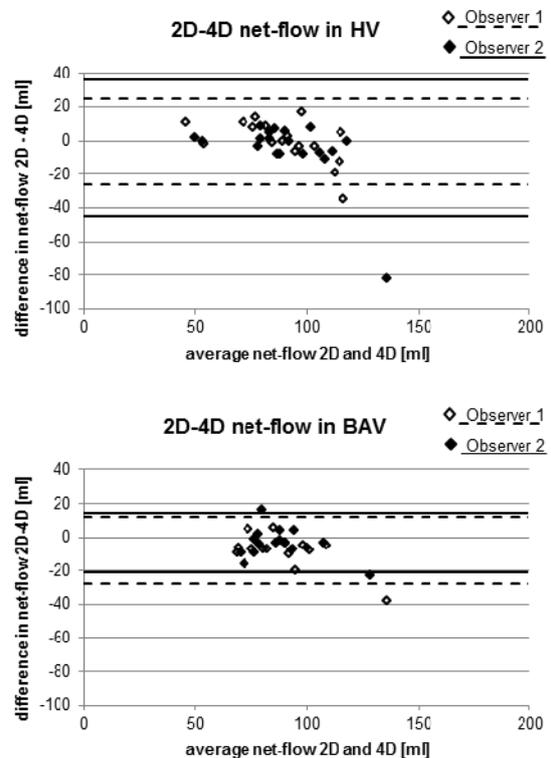


Figure 1 Bland-Altman-plot: Agreement of 2D- and 4D- net-flow-volumes in the ascending aorta of 34 participants (BAV n=16, HV n=18).