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#### 4-dimensional flow patterns in the ascending aorta differ strongly between bicuspid and tricuspid aortic valves

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##### Introduction:

Bicuspid aortic valves (BAV) are frequently associated with dilation, aneurysm and dissection of the ascending aorta. Two opposing hypotheses advocate either an inborn connective tissue defect or dilation secondary to altered blood flow conditions in the ascending aorta.

This study was initiated to evaluate flow patterns in the ascending aorta of BAV patients compared to those in individuals with tricuspid aortic valve (TAV) using four-dimensional cardiovascular magnetic resonance (CMR).

##### Methods:

18 healthy individuals with normally functioning BAV, without aortic stenosis, aortic regurgitation or dilation were compared with an age and sex matched control group of volunteers with tricuspid aortic valve (TAV). 4D blood flow data were obtained by CMR (spatial resolution =  $2.1 \times 1.7 \times 2.5 \text{ mm}^3$ , temporal resolution = 39.2 ms) and visualization was performed with dedicated software. Evaluation of different flow patterns was performed by three blinded observers and flow alterations were classified into four groups concerning their intensity.

##### Results:

In 90% BAV and TAV were correctly classified in blinded evaluation of flow visualization. Abnormal helical flow patterns in the ascending aorta were seen in 85% of the evaluations in the BAV group. In the TAV group altered flow was only found in 6%. Comparison of flow patterns in the matched pairs revealed a significant difference between patients with BAV and the control group ( $p = 0.0004$ ).

Figure 1.

##### Conclusions:

Patients with BAV without concomitant valve or vessel disease have a significantly different 4D flow pattern than patients with TAV. This altered flow may have an important impact on the development of aortic dilation in patients with BAV

We further suggest that connective tissue defect may only be a secondary finding in these patients.

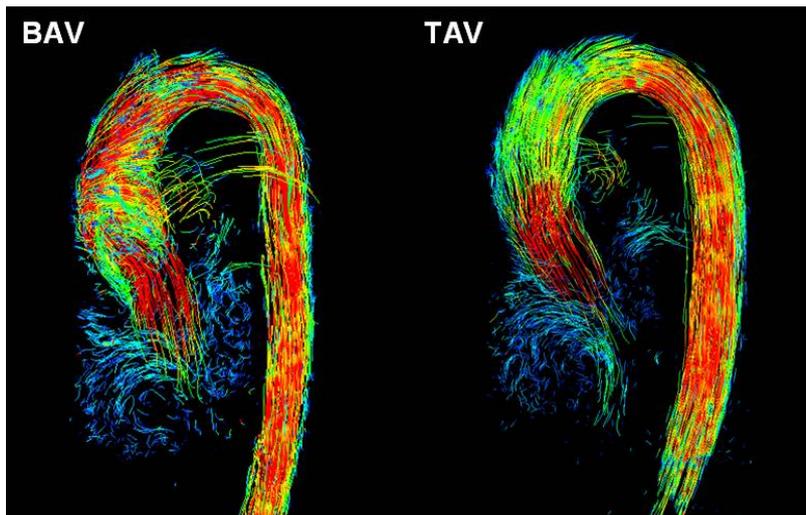


Figure 1: 4D flow visualization of blood flow of the thoracic aorta in two 32-year old women. (BAV: bicuspid aortic valve; TAV: tricuspid aortic valve)