Letter by Hope et al Regarding Article, "Bicuspid Aortic Cusp Fusion Morphology Alters Aortic Three-Dimensional Outflow Patterns, Wall Shear Stress, and Expression of Aortopathy"

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We read with great interest the recent article by Dr. Mahadevia and colleagues about altered systolic flow and aortopathy with bicuspid aortic valve (BAV), and the related editorial by Drs. Uretsky and Gillam.\textsuperscript{1, 2}

We are pleased that the hemodynamic parameter of \textit{flow displacement} performed well. It showed the clearest differences between patients with BAVs and controls, and correlated with the prearch dilation seen in patients with right-noncoronary leaflet fusion.\textsuperscript{1} Our experience with the parameter has been equally encouraging. It is easy to measure, shows excellent reproducibility, and appears to correlate well with aortic growth in initial application.\textsuperscript{3} We would like to point out, however, a technical difference between how Mahadevia et al. used \textit{flow displacement}, and how it was originally intended. The parameter was correctly used to measure the distance between the “center of velocity” of forward flow and the anatomic center of the aorta. The difference is that this distance should then be normalized by the lumen diameter. This minimizes the influence of aortic geometry (note that Mahadevia et al. report elevated flow displacement with dilated aortas versus healthy volunteers; given the similar diameters of the patients with BAV and sized-matched controls, however, this influence was effectively mitigated), and maximizes the impact of valve morphology on flow. We believe this gives \textit{flow displacement} the greatest likelihood of predicting disease progression caused by valve-related alteration of systolic flow.

As Uretsky and Gillam note, one problematic aspect of the work of Mahadevia et al. is that only patients with dilated aortas are included. On the one hand, this makes sense: the goal was to correlate leaflet fusions with the different patterns of aortopathy, so the focus was on older patients who had developed aortic dilation. However, from the larger perspective of the
clinical applicability of MR flow imaging, patients without aortic dilation or valve disease are uniquely interesting. They are the most likely to fall off the radar of conventional surveillance imaging. Yet as Michelena et al. report, patients who fit this profile – young patients without significant aortic or aortic valve disease – experience substantial morbidity. The value of MR flow imaging may be to better risk stratify such patients through the early identification of abnormal flow that would otherwise go undetected by conventional imaging.

Not all patients with BAV have abnormal systolic flow, as Uretsky and Gillam discuss. Instead, a range of leaflet abnormalities restrict normal systolic opening to varying degrees. The more restricted the leaflet motion, the greater the deflection of flow from the vessel midline. Furthermore, as small initial studies from Della Corte et al. and our group suggest, the greater the flow deflection (i.e., the greater the flow displacement), the faster the ascending aorta grows. An important similarity between these initial studies is the focus on young patients with minimal aortic and aortic valve disease. This cohort should feature prominently in the larger, longitudinal studies that Uretsky and Gillam allude to for more convincing assessment of the relationship between flow abnormalities and disease progression with BAV.

Disclosures: None.

References:

