

## IMAGE FOCUS

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## Six-year serial follow-up with aortic 4D flow cardiovascular magnetic resonance in a patient with bicuspid aortic valve

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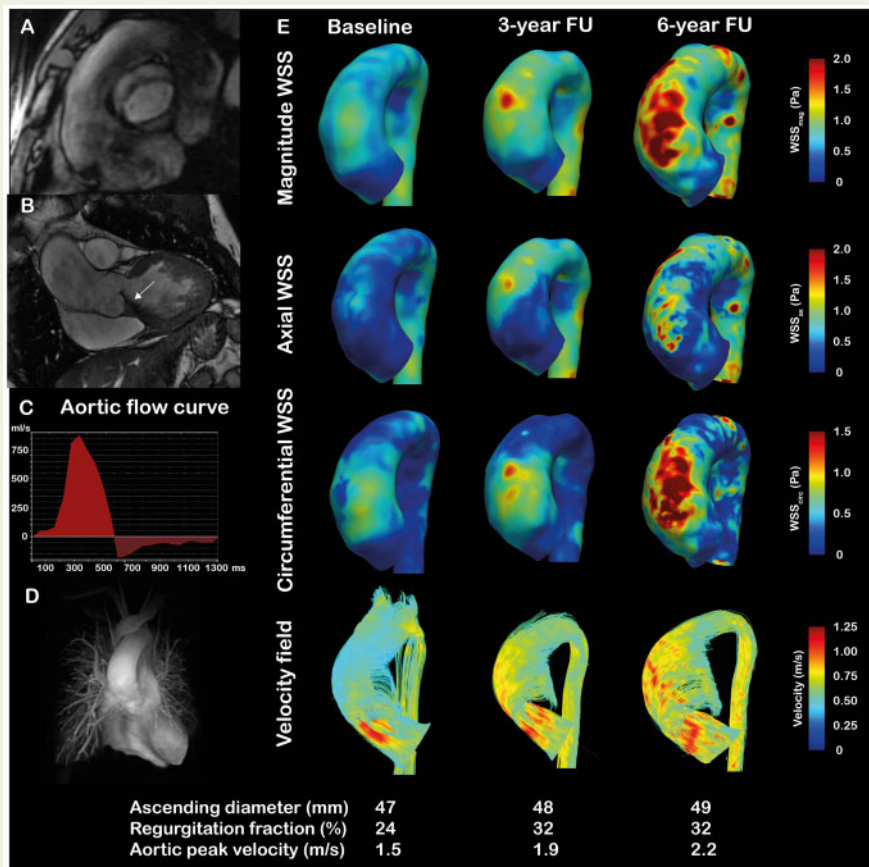
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A 36-year-old asymptomatic man with a history of left-right bicuspid aortic valve (Panel A) with moderate eccentric aortic regurgitation (Panels B and C) and ascending aortic dilation (Panel D) (47 mm) underwent a cardiovascular magnetic resonance (CMR) exam three times within six years to monitor disease progression. CMR examination included 2D and 4D flow imaging and angiography for the assessment of aortic valve area, peak velocities, regurgitation fraction, wall shear stress (WSS), and aortic diameters in the ascending aorta. WSS was analysed during peak systole at all three time points. In addition to the magnitude of the WSS, the circumferential and axial components were assessed (Panel E).

During the six years, the aortic root dimension (46 mm) and aortic valve area measured by planimetry (6.8 cm<sup>2</sup>) remained unchanged. The maximum ascending aorta dimension increased gradually from 47 mm to 49 mm. This was accompanied by a striking change in WSS pattern at the ascending aortic wall. The average WSS increased during follow-up from  $0.7 \pm 0.2$  Pa to  $1.0 \pm 0.4$  Pa (Panel E). This was mainly due to an increase in the circumferential component of the WSS, indicating a more helical aortic flow during follow-up. Meanwhile, peak aortic velocities and normalized flow displacement increased from 1.5 m/s to 2.2 m/s and from 0.10 to 0.12, respectively, while the aortic regurgitation fraction increased from 24% to 32%.

WSS patterns have been associated with distinct aortic dilation morphotypes and might be a marker of aortic growth. In our patient, aortic 4D flow provided additional information and clearly demonstrated the concomitant mechanistic effects of aortic valve disease progression on the aorta.



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