

Differences in left ventricular geometry and function between patients with bicuspid and tricuspid aortic valve stenosis.

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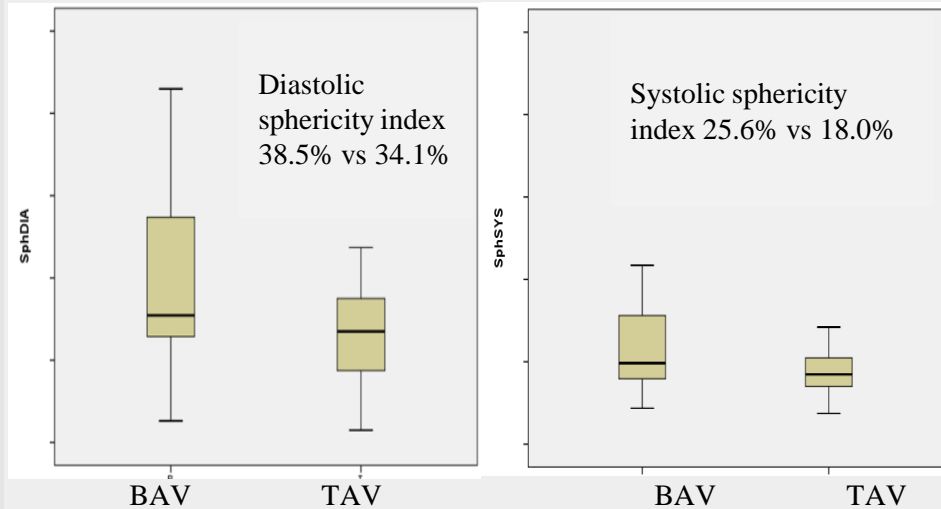
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Background:

Aortic valve stenosis (AS) is an increasing healthcare burden (3% over 70 years affected by severe AS). Although only present in 1-2% of the population, bicuspid aortic valves (BAV), account for over 50% of severe aortic valve disease. They may have earlier abnormalities of left ventricular strain because of the longer standing effects on the LV. While resting strain abnormalities have been shown in normally functioning BAV compared to healthy controls, LV geometry and strain has not, to our knowledge, been compared in groups with established tricuspid (TAV) and bicuspid (BAV) aortic stenosis. We hypothesise that LV geometry and function may differ between these groups, despite similar valve areas, reflecting the longer standing nature of BAV disease.

Methods:

76 participants with asymptomatic moderate to severe AS (39 BAV; 37 TAV) underwent cardiac MRI (CMR) scanning at 1.5 Tesla. Proprietary feature tracking software was used to calculate longitudinal and circumferential peak systolic strain, strain rate and diastolic strain rate. Circumferential strain was measured at the LV base, mid ventricle and apex. LV dimensions, mass and ejection fraction were derived from standard CMR software. The sphericity index is the ratio of LV end-diastolic volume to a sphere with a diameter equal to the LV long axis dimension in diastole; repeated in systole.



Results:

Participants with bicuspid aortic valves were slightly younger (BAV 66.5 ± 5.8 years vs TAV 71.5 ± 6.3 years). LV end diastolic volumes showed a trend towards being slightly larger in the BAV group (74ml/m^2 vs 68.3ml/m^2 , $p = 0.09$). The LV diastolic and systolic sphericity index was higher in the BAV group: Diastolic sphericity index: BAV 38.5% (95% CI 35.5-41.8.) vs TAV 34.1% (95% CI 31.6 – 36.6), $p = 0.03$ (normal values $29 \pm 7\%$).

Systolic sphericity index: BAV 25.6% (95% CI 19.9 – 31.5) vs TAV 18.0% (95% CI 15.0 -21.0), $p = 0.02$ (normal values $15 \pm 8\%$).

There was no significant difference in LV ejection fraction or LV mass index. Both systolic and diastolic strain values were not significantly different between groups. Global longitudinal strain (-17.4 BAV vs -16.6 TAV, $p = 0.44$); Peak circumferential strain at Base LV (-26.4 BAV vs -28.0 TAV, $p = 0.16$); Mid (-25.5 BAV vs -26.4 , $p = 0.40$); Apex (-34.2 BAV vs -34.5 , $p = 0.86$).

Conclusions:

Bicuspid aortic stenosis is associated with a more spherical left ventricle, in both systole and diastole than tricuspid aortic valve stenosis; whether this reflects an early adverse change requires further study. However, in this small study, despite the longer duration of aortic valve disease in the BAV group and altered LV geometry, it appears that the LV adapts well and there are no important functional differences compared to a similar group with acquired AS.