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Severe aortic stenosis with high valvulo-arterial impedance (Zva) has more adverse cardiac changes on cardiovascular magnetic resonance

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Background

The most important challenge in asymptomatic severe aortic stenosis (AS) is the timing for intervention. Valvulo-arterial impedance (Zva), an overall after-load assessment, was shown to be one of the most comprehensive indexes to assess AS. This study aims to evaluate the impacts of Zva on cardiac MRI (CMR) parameters.

Methods

Patients with severe AS had both pre-operative CMR and trans-thoracic echocardiography (TTE) within one week apart. From TTE, on top of the routine measurements, Zva was calculated as the sum of systolic blood pressure and the aortic valve continuous-wave Doppler mean gradient divided by the left ventricular stroke volume index. Patients were categorized into 2 groups according to their calculated Zva: (a) High Zva (≥4.5 mmHg/mL/m^2), and (b) low Zva (<4.5). CMR parameters, namely left ventricle mass index (LVMI), ejection fraction (LVEF), end-diastolic volume (LVEDV), right ventricle end-diastolic volume (RVEDV) and left atrium volume index (LAVI), were compared between the 2 groups.

Results

36 patients were recruited into the final analysis. They were categorized into 2 groups, high Zva (n = 16) and low Zva (n = 20). Baseline characteristics in both groups were comparable except patients in high Zva group had significantly higher systolic blood pressure (p = 0.026). Both aortic valve area (AVA) by continuity equation on echo and by direct planimetry on CMR were similar in both groups (p = 0.91 and 0.295 respectively). Patients with high Zva had higher LVMI (p = 0.03), lower LVEF (p = 0.04), higher LVEDV (p = 0.03) and RVEDV (p = 0.04), and higher LAVI (p = 0.04).

Table 1 TTE and CMR parameters between high and low Zva groups

	Low Zva (n = 20)	High Zva (n = 16)	p-value
Age	79.2	76.4	0.82
BAV	4 (20%)	4 (25%)	0.72
SBP (mmHg)	132.4	149.8	0.026
Zva (mmHg/mL/m2)	3.62 ± 0.17	5.23 ± 0.77	0.006
AVA-TTE (cm2)	0.86 ± 0.09	0.86 ± 0.13	0.91
AVA-CMR (cm2)	0.78 ± 0.17	0.81 ± 0.07	0.295
LVMI-CMR (g)	82 ± 16.2	110 ± 18	0.034
LVEF-CMR (%)	66 ± 12.8	50 ± 8.2	0.047
LVEDV-CMR (mL)	127 ± 38.4	184 ± 28.4	0.03
RVEF-CMR (%)	59 ± 6.3	56 ± 10.4	0.1
RVEDV-CMR (mL)	108.2 ± 22.4	128.6 ± 22	0.042
LAVI-CMR (mL/m2)	65 ± 15.3	76 ± 12.5	0.044

Conclusions

In setting of severe aortic stenosis, despite tight aortic valve areas, patients with high valvulo-arterial impedance have worse cardiac parametes and functions on CMR than those with low valvulo-arterial impedence.

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