Association of aortic valve size with the degree of aortic valve calcification in patients with severe aortic stenosis

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Background: The development and progression of aortic valve calcification (AVC) is a major contributor to the severity of aortic stenosis (AS). Currently, the 2021 ESC/EACTS Guidelines recommend the use of the Agatston AVC score to predict the likelihood of severe AS in patients with unclear echocardiographic AS severity. It has been shown that AS in women is associated with less AVC, thus lower AVC thresholds for the diagnosis of severe AS in women are recommended. It has furthermore been demonstrated that women generally have smaller hearts. However, whether small aortic valve (AV) size, independent from sex, is associated with less AVC in patients with severe AS has not been explored.

Purpose: The aim of this study was to assess the association of AV dimension and the degree of AVC in severe AS.

Methods: AVC was assessed on computed tomography using the Agatston score in consecutive patients with severe AS. AV diameter and indexed AV annulus area adjusted for body surface area were measured. To analyze the association with AVC, Spearman rank correlation as well as multivariate linear regression models adjusted for age, sex, left ventricular ejection fraction and cardiovascular risk factors were performed.

Results: In total 446 patients (mean age 81±6 years, 45% female) were included. Median Agatston Score was 2949 AU [2135-3986] in men and 1755 AU [1303-2571] in women. Mean AV diameter was 24±2mm and mean indexed annulus area was 248±43mm².

We observed a significant correlation between AV Agatston score and AV diameter (r=0.6; p<0.001 Figure 1 Panel A) as well as between AV Agatston score and indexed annulus area (r=0.5; p<0.001; Figure 1 Panel B). On multivariate analysis AV diameter (β=273; p<0.001), indexed annulus area (β=13; p<0.001) and sex (β=396; p<0.001) were independently associated with AVC by the Agatston score. In addition, separate regression analyses in men and women showed a significant association of AV diameter (β(men)=265; β(women)=275; both p<0.001) and indexed annulus area (β(men)=13; β(women)=11; both p<0.001) with the AV Agatston score. Hypertension, dyslipidemia, diabetes mellitus, smoking and chronic kidney disease showed no statistically significant association with the amount of AVC.

Conclusion: Our results indicate that patients with severe AS and larger AV dimensions present with more AVC on Agatston scoring, independent from sex. From surgical data, it is known that smaller aortic bioprostheses cause higher gradients, consequently we hypothesize here, that less calcification is required in small valves to cause significant narrowing. Thus, AVC cut-offs for the diagnosis of AS should be indexed for AV size rather than sex.