

Leaflets fusion length in bicuspid aortic valve is related to ascending and aortic root dilation and ascending aorta wall shear stress

Guala A.; Evangelista A.; La Mura L.; Teixido-Tura G.; Dux-Santoy L.; Ruiz-Munoz A.; Cinque A.; Valente F.; Lopez-Sainz A.; Galian-Gay L.; Gutierrez L.; Gonzalez-Alujas T.; Sao-Aviles A.; Ferreira I.; Rodriguez-Palomares JF.

University Hospital Vall d'Hebron, Cardiology, Barcelona, Spain

Funding Acknowledgements: Type of funding sources: Public Institution(s). Main funding source(s): Spanish Ministry of Science, Innovation and Universities, Instituto de Salud Carlos III

Background: Bicuspid aortic valve (BAV) is the most common congenital heart defect, consisting in the fusion of two aortic valve leaflets. Altered flow patterns have been related to aortic wall degeneration in BAV patients and may be responsible for the high prevalence of aortic disease in these patients. A number of studies on excised BAV or using advanced imaging modalities reported a wide variability of fusion extent between leaflet, but no previous study assessed whether leaflet fusion length may be used to stratify BAV patients.

Purpose: We aimed to test whether leaflet fusion extent can be quantified by cardiac magnetic resonance imaging (CMR) and whether it is related to aortic dilation and flow abnormalities in non-dysfunctional BAV.

Methods: One hundred and twenty BAV adults with no previous aortic or aortic valve surgery or significant valvular disease were consecutively enrolled. Patients with two sinuses of Valsalva (true BAV) or fusion of the left and non-coronary cusps, both being rare forms of BAV, were excluded. Twenty-eight healthy volunteers were also included for comparison. A 4D flow CMR sequence was acquired and circumferential wall shear stress and pulse wave velocity were assessed in the ascending aorta. A stack of double-oblique cine images of the aortic valve were used to quantify the length of the fusion between leaflets.

Results: The length of the fusion between leaflets was effectively measured in 112/120 patients (93%). Reproducibility was good (ICC = 0.826). Fusion length varied greatly (range 2.3 – 15.4 mm, 7.8 ± 3.2 mm, tertiles cut-off points were 6 and 9.3 mm). After correction for age, BSA, stroke volume and BAV fusion morphotype, fusion length was independently associated with diameter at the sinus of Valsalva ($p = 0.002$). Moreover, once corrected for age, stroke volume and ascending aorta pulse wave velocity, fusion length was positively related to ascending aorta diameter ($p = 0.028$). The comparison of maps of circumferential peak-systolic WSS in healthy volunteers (left) and BAV patients pertaining to the three leaflet fusion length tertiles is shown in Figure 1. Circumferential WSS progressively increase with larger fusion length. This trend was statistically significant ($p < 0.05$) in the right and outer regions of the proximal and mid ascending aorta.

Conclusions: Bicuspid aortic leaflet fusion length varies considerably and it is independently associated with ascending aorta and aortic root dilation, possibly through flow alterations.

Abstract Figure 1

