



**Karolinska
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Department of Molecular Medicine and Surgery

Vascular function in bicuspid aortic valve disease

AKADEMISK AVHANDLING

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ABSTRACT

The aortic valve normally consists of three cusps (tricuspid aortic valve, TAV), but in 0.5-2% of the population it consists of only two cusps (bicuspid aortic valve, BAV), which is the most common congenital cardiac malformation. BAV is prone to aortic stenosis (AS) and regurgitation (AR), and >25% of BAV patients will require surgery of the aortic valve and/or aorta within 20 years of diagnosis. BAV is associated with impaired function, dilation and dissection of the ascending aorta, while little is known about the abnormalities of the descending aorta in BAV.

The aims of this thesis were to investigate morphological and functional alterations in the aorta of BAV and TAV patients, with a focus on the descending aorta, and to assess the feasibility of a new ultrasound-based method for studies of the elastic properties of the aorta. This was performed using transesophageal echocardiography (TEE) in consecutive patients without significant coronary artery disease having aortic valve disease and/or ascending aortic aneurysms requiring surgery (>50 % with BAV).

In Study I ($n = 300$), we examined if different phenotypes of BAV (according to surgical inspection) were associated with different types of ascending aortic dilation. We did not find any such association. Ascending aortic dilation was common in patients with AS and BAV but not with TAV.

In Study II ($n = 85$), a new modality, Velocity Vector Imaging (VVI), which is based on speckle tracking, was evaluated for automated deformation analysis of the descending aorta using TEE images. The method was found to be feasible for aortic studies. We could compute elasticity indices of the aorta with low variability and a strong correlation to indices calculated with a standard method (M-mode).

In Study III ($n = 192$), we used VVI to compare aortic elasticity between BAV and TAV patients. After correction for age, dimension of the ascending aorta, cholesterol, and stroke volume in a multivariable regression model, BAV was associated with lower strain and distensibility of the descending aorta in the AR group, and higher distensibility in the AS group.

In Study IV ($n = 369$), we examined the intima-media thickness (IMT) in the descending aorta and found no difference between BAV and TAV. Thus, the functional alterations of the aorta found in Study III seem not to depend on structural wall changes. Furthermore, we could show that genetic markers (single nucleotide polymorphisms, SNPs), which influence IMT in the carotid artery seem to correlate to IMT in the descending aorta in patients with TAV.

In conclusion, we found no association between dilation of the ascending aorta and a specific BAV phenotype. We demonstrated that VVI technique is feasible for analysis of elastic properties of the aorta. In patients with AR, BAV was associated with lower strain and distensibility than TAV, suggesting impairment of the elastic aortic properties in the descending aorta. IMT was not influenced by presence of BAV.