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Editorial

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# The Potential of Blood Speckle Imaging and $^{18}$F-Sodium Fluoride Positron Emission Tomography/Computed Tomography in Evaluating the Progression and Inflammation in Aortic Stenosis

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▸ See the article "Trans-Aortic Flow Turbulence and Aortic Valve Inflammation: A Pilot Study Using Blood Speckle Imaging and $^{18}$F-Sodium Fluoride Positron Emission Tomography/Computed Tomography in Patients With Moderate Aortic Stenosis" in volume 31 on page 145.

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Aortic stenosis disease progression occurs through serial inflammatory reactions, calcification, and fibrosis, which are associated with various physiological pathways.[1)2)] There are no active disease biomarkers available for its detection or personalized treatments that can delay inflammation progression.[1)3)] Currently, cardiovascular calcification is visualized using noninvasive conventional imaging modalities such as echocardiography, computed tomography (CT), and cardiac magnetic resonance imaging (CMR).[4)]

Among these imaging modalities, $^{18}$F-sodium fluoride ($^{18}$F-NaF) positron emission tomography (PET)/CT, a noninvasive imaging technique, allows identification and quantification of specific biochemical processes within the aortic valve. It provides measurable information about the calcification activity and inflammation in the aortic valve, with the uptake correlating with macrophage burden.[5-7)] $^{18}$F-NaF PET/CT provides pathophysiological insights and has emerged as a marker of vascular injury and a predictor of disease progression.

Doppler echocardiography is routinely used in clinical practice to assess the severity of aortic stenosis. Blood speckle imaging (BSI) has recently emerged as an alternative and additional method to Doppler echocardiography for assessing aortic stenosis severity. In BSI, the induction of turbulent flow in the trans-aortic area is caused by vascular damage with calcification and inflammation, while 4-dimensional (4D) flow CMR measures the qualitative and the quantitative vascular hemodynamics. It is a reference method for monitoring longitudinal changes in the ventricular remodeling response in patients with aortic stenosis.[8)9)]

Clinically, acquiring blood flow velocity data in BSI is advantageous as it allows pressure drop calculation from cross-sectional profile velocity data, rather than from a single streamlined

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conventional Doppler echocardiography.[10] Ultimately, BSI can visualize the shear stress applied to the aortic wall and vessel damage, while $^{18}$F-NaF PET/CT has emerged as a technique that evaluates disease activity and predicts disease progression and prognosis in patients with aortic stenosis.[11]

In this issue of the *Journal of Cardiovascular Imaging*, Park et al.[12] investigated the essential relationship between the degree of trans-aortic turbulence measured by BSI with transesophageal echocardiography (TEE), and the inflammation activity in the aortic valve region measured by $^{18}$F-NaF PET/CT in patients with moderate aortic stenosis. The authors found a significant positive correlation between the maximum standardized uptake values and the turbulent flow area ratio, indicating that higher degrees of turbulent flow are associated with greater aortic valve inflammatory activity. The authors report the benefits in terms of cost and time, while using BSI with TEE to predict the aortic stenosis progression instead of 4D flow CMR. In addition, the results are clinically relevant as they have tried to visualize and evaluate disease progression and activity (calcification and inflammation) using the $^{18}$F-NaF PET/CT.

This study was a pilot study. Nevertheless, it had several advantages, including the use of two imaging modalities to assess different aspects of aortic stenosis and focus on patients with moderate disease, which is a critical stage for intervention. However, the small sample size and the single time-point readings limit the applicability of the data.

Overall, this study explains BSI as a potential clinical tool that can predict aortic stenosis progression and patient prognosis. Further research is required to confirm and extend these findings in a large diverse patient population and explore the potential mechanisms underlying this relationship. A better understanding of the pathophysiology of aortic stenosis may lead to improved diagnostic and treatment strategies for this common and often debilitating condition.

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**Conflict of Interest**

The author has no financial conflicts of interest.

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