Increased aortic valve uptake of sodium fluoride is associated with higher cardiovascular risk: assessing pathophysiology with PET/CT

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Introduction: Positron emission tomography-computed tomography (PET-CT) with 18F-sodium fluoride (18F-NaF) has been used in clinical research to characterize active microcalcification in aortic valve disease. However, its role in apparently healthy patients remains unknown.

Purpose: We aimed to characterize the aortic valve uptake of 18F-NaF in patients with high cardiovascular (CV) risk without known aortic valve disease.

Methods: Forty high CV-risk individuals without previous CV events or known aortic valve disease were scanned with 18F-NaF PET-CT. Aortic valve uptake of 18F-NaF was evaluated in 3-D multiplanar fusion images, considering top to bottom of the aortic valve for the establishment of circular regions of interest (ROI) around the valve. Maximum and mean standardized uptake values (SUV) estimated for each slice and the whole valve were corrected for blood-pool activity (mean of five ROI in the mid lumen of superior vena cava) by subtraction (corrected uptake per lesion, CUL) and division (tissue to background ratio, TBR). All patients underwent transthoracic echocardiography for aortic valve evaluation.

Results: The patients presented a mean age of 64.63 ± 8.87 years and 65% were males. The mean SCORE2 was 13.28 ± 8.48 and the mean ASCVD was 32.30 ± 20.55. Median CUL was 0.52, IQR 0.41-0.64, and median TBR was 1.62, IQR 1.47-1.75. The mean peak aortic valve velocity was 1.71 ± 0.41 m/s while the mean peak and mean gradients were 12.18 ± 5.47 mmHg and 6.50 ± 3.13 mmHg, respectively. Only 2 patients fulfilled the echocardiographic criteria for mild aortic stenosis. Patients were grouped according to the 50th percentile of both the ASCVD risk score and the SCORE2. Maximum SUV was associated with higher CV risk predicted by ASCVD risk score (1.60, IQR 1.25-1.55 vs 1.30, IQR 1.25-1.55; p<0.01) and SCORE2 (1.60, IQR 1.30-1.95 vs 1.30, IQR 1.15-1.65; p=0.02), but not mean SUV. After correction for blood-pool activity, higher CV risk was associated with increased CUL both for ASCVD risk score (0.59, IQR 0.52-0.92 vs 0.44, IQR 0.28-0.53; p<0.01) and SCORE2 (0.59, IQR 0.52-0.84 vs 0.43 0.27-0.53; p<0.01). Higher CV risk was also associated with increased TBR, both for ASCVD risk score (1.71, IQR 1.59-1.77 vs 1.51, IQR 1.25-1.66; p<0.01) and SCORE2 (1.70, IQR 1.59-1.77 vs 1.51, IQR 1.25-1.66; p<0.01). There were no significant correlations between echocardiographic variables and neither maximum SUV, mean SUV, CUL, nor TBR.

Conclusion: Increased aortic valve uptake of 18F-NaF is associated with higher CV risk predicted by ASCVD risk score and SCORE2. In this cohort without known aortic valve disease, there was no link between aortic valve uptake of 18F-NaF and echocardiographic variables. Further studies with larger populations must confirm these findings and evaluate the potential role of increased aortic valve uptake of 18F-NaF in predicting disease progression.